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रेडियो व्यवधान लक्षणों की मापन पद्धतियां एवं सीमाएं

भाग 2 घरेलू और समान प्रयोजनों के लिए विद्युत मोटर चालित और ताप साधित्र, विद्युत औजार और समान विद्युत उपकरण

(पहला पुनरीक्षण)

Indian Standard

LIMITS AND METHODS OF MEASUREMENT OF RADIO DISTURBANCE CHARACTERISTICS

PART 2 ELECTRICAL MOTOR-OPERATED AND THERMAL APPLIANCES FOR HOUSEHOLD AND SIMILAR PURPOSES, ELECTRIC TOOLS AND ELECTRIC APPARATUS

(First Revision)

ICS 33 : 100

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

December 1999

Price Group 15

Amendment 1

Replace the reference number CISPR 14 *by* CISPR 14-1.

Replace the existing title of this standard by the following:

Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission – Product family standard.

Page 15

5.2.2.1 *Appliances normally operated without an earth connection and not held in the hand*

Add the following new text at the end of this subclause:

Equipment that, according to its design and/or weight, usually stands on the floor while in use (so-called floor standing equipment) is subject to the same provisions as above.

However,

- the equipment shall be placed on a horizontal metal ground plane (the reference ground plane), but isolated from it by a non-metallic support (such as a pallet) of 0,1 m ± 25 % in height;
- the lead shall be led downward along the EUT to the level of the non-metallic support and be led horizontally to the artificial V-network;
- the artificial V-network shall be bonded to the reference ground plane (see CISPR 16-2);
- *the reference ground plane shall extend at least 0,5 m* beyond the boundaries of the EUT and have minimum dimensions of 2 m by 2 m.

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7.1.4, second paragraph

Change the second line into "1,1 times the rated voltage in order to check whether the level ..."

Electromagnetic Compatibility Sectional Committee, LTD 22

NATIONAL FOREWORD

This Indian Standard (Part 2) (First Revision) which is identical with CISPR 14 (1993) 'Limits and methods of measurement of radio disturbance characteristics of electrical motor-operated and thermal appliances for household and similar purposes, electric tools and electric apparatus' [along with Amendment 1 (1996) and Amendment 2 (1998)], issued by the Special Committee on Radio Interference (CISPR), was adopted by the Bureau of Indian Standards on the recommendation of the Electromagnetic Compatibility Sectional Committee and approval of the Electronics and Telecommunication Division Council.

This standard was originally published in 1977 and was largely based on CISPR 14 (1975). The standard covered the methods of measurement of electromagnetic interference from household appliances, portable tools and similar electrical apparatus. This revision is now being undertaken to include the limits along with the methods of measurement of radio disturbance characteristics of electrical motor operated and thermal appliances for household and similar purposes, electric tools and electric apparatus and also to align the standard with the latest edition of CISPR 14 The limits for electromagnetic interference were earlier covered in IS 6842 : 1997 'Limits for electromagnatic interference — Specification' which has since been withdrawn.

In the adopted standard, certain conventions are not identical to those used in Indian Standards. Attention is particularly drawn to the following :

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

Amendment No. 1 (1996) and Amendment No. 2 (1998) to the above International Standard have been printed at the end.

CROSS REFERENCES

In this adopted standard, reference appears to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards which are to be substituted in their place are listed below along with their degree of equivalence for the editions indicated :

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
CISPR 16-1 (1993) Specification for radio disturbance and immunity measuring apparatus and methods — Part 1 : Radio disturbance and immunity measuring apparatus	IS 10052 (Part 1) : 1999 Specification for radio disturbance and immunity measuring apparatus and methods : Part 1 Radio disturbance and immunity measuring apparatus (*first revision*)	Identical
CISPR 16-2 : 1996 Specification for radio disturbance and immunity measuring apparatus and methods — Part 2 : Methods for measurement of disturbances and immunity	IS 10052 (Part 2) : 1999 Specification for radio disturbance and immunity measuring apparatus and methods : Part 2 Methods of measurement of disturbances and immunity (*first revision*)	do
IEC 50 (161) : 1990 International Electrotechnical Vocabulary (IEV) — Chapter 161 : Electromagnetic compatibility	IS 1885 (Part 64/Sec 1&2) : 1987 Electrotechnical vocabulary : Part 64 Electromagnetic compatibility, Section 1 General terms, Section 2 Specific terms	Technically Equivalent

(*Continued on third cover*)

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Subclause 7.3.1.16.2

Replace the text of this subclause by the following:

7.3.1.16.2 *Paper shredders*

The device shall be tested for continuous disturbances while the device is fed continuously with paper, resulting in continuous operation of the drive (if possible).

The device shall be tested for discontinuous disturbances while the device is fed with one single sheet at the time, allowing the motor to switch off between each sheet.

The paper shall be suitable for typewriter or copying machine, and shall have a length between 278 mm and 310 mm independent of the dimensions for which the shredder is designed. The weight category shall be 80 g/m².

Page 28

Add following new subclause 7.3.1.20 after 7.3.1.19.

7.3.1.20 *Air conditioning equipment*

7.3.1.20.1 If the air temperature is controlled by changing the time interval of operation of the compressor motor used in the appliance, or the appliance has heating device(s) controlled by thermostat(s), measurements shall be made according to the same operating condition as in 7.3.4.14.

7.3.1.20.2 If the appliance is a variable capacity type which has inverter circuit(s) that control(s) the revolution of the fan or compressor motor, measurements shall be made with the temperature controller setting at the lowest position when in cooling mode, and at the highest position when in heating mode.

7.3.1.20.3 The ambient temperature for testing the equipment by 7.3.1.20.1 and 7.3.1.20.2 shall be (15 ± 5)°C when the appliance is operating in heating mode, and (30 ± 5)°C when it is operating in cooling mode. If it is impractical to keep the ambient temperature within this range, another temperature is also permissible, provided that the equipment operates in a stable manner.

The ambient temperature is defined at the temperature of the air flow to the indoor unit.

7.3.1.20.4 If the appliance consists of indoor and outdoor units (split type), the length of connecting refrigerant pipe shall be 5 m ± 0,3 m, and the pipe shall be shaped like a coil with a diameter of approximately 1 m. If the pipe length cannot be adjusted, it shall be longer than 4 m, but not longer than 8 m. The connecting leads between the two units shall be routed along the refrigerant pipe. Where an earthing conductor is required, but not included in the mains lead, the earthing terminal of the outdoor unit shall be connected to the reference ground (see 5.2.1, 5.2.2 and 5.2.3). The artificial V-network shall be situated at a distance of 0,8 m from the unit (either the indoor or outdoor unit) which is connected to the mains network.

Amendment 2

Page 4

2 Normative references

Insert, in the existing list, the title of the following standard:

IEC 60335-2-76:1997, *Safety of household and similar electrical appliances – Part 2: Particular requirements for electric fence energizers*

Page 8

Renumber subclause 4.1.1.4 as 4.1.1.5 and add the following new subclause 4.1.1.4:

4.1.1.4 Limits for electric fence energizers apply to

a) the fence terminals on all energizers (columns 4 and 5 of table 1);

b) the mains terminals on energizers designed for connection to the mains (columns 2 and 3 of table 1);

c) the battery terminals on energizers designed for operation from a battery (columns 4 and 5 of table 1).

However, no limits apply to the battery terminals of energizers with built-in batteries which cannot be connected to the mains supply, or energizers with external batteries if the connecting lead between the energizer and the battery is shorter than 2 m and is not capable of being easily extended by the user without special tools.

Type D energizers, according to IEC 60335-2-76, are measured as battery operated energizers with connecting leads between the energizer and the battery greater than 2 m in length.

NOTE – In practice the fence wire can also act as an active source of disturbances, due to the high-voltage discharges, in particular to radio and telecommunication networks. Manufacturers of electric fence energizers should instruct the users to eliminate discharge points such as touching vegetation or a broken fence wire.

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8.3.1, 8th line

Replace the existing equation for the following:

$$S_n^2 = \sum (x - \bar{x})^2 / n-1)$$

8.3.1, 12th line

Replace s_n *by* S_n^2

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Figure 9, 6th line

Replace $N > 30$ or $N > 2$ clicks in 2 s *by* $N \geq 30$ or $N > 2$ clicks in 2 s.

Page 9

Replace the existing subclause 4.1.2.4 by the following new subclause 4.1.2.4:

Regulating controls which incorporate semiconductor devices, electric fence energizers, rectifiers, battery chargers and convertors which do not contain any internal frequency or clock generator operating at frequencies higher than 9 kHz are not subject to the disturbance power requirements in the frequency range 30 MHz to 300 MHz.

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7.3.7.2 Electric fence supply units

Replace the first paragraph of subclause 7 3.7.2 by the following new text:

When measuring the disturbance voltage at the fence terminals of the electric fence energizer, the fence wire shall be simulated by a series RC circuit comprising a 10 nF capacitor (surge voltage at least equal to the no-load output voltage of the electric fence energizer) and a 250 Ω resistor (the 50 Ω in parallel with 50 µH incorporated in the artificial mains V-network provides the balance of the required 300 Ω load resistance) connected as shown in figure 6.

The leakage resistance of the fence wire is represented by a resistor of 500 Ω placed in parallel to the series circuit.

A correction factor of 16 dB shall be added to the measured values for the fence terminals due to the voltage division resulting from the use of this fence equivalent circuit.

When measuring, the appliance shall be operated in the normal position with a maximum inclination of 15° from the vertical position.

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Figure 6

Amend the definition of item 4 to read:

Mains lead, or battery lead

Replace the definition of item 6 by the following new definitions:

6 Resistor of 500 Ω to simulate leakage (to be added to the equivalent circuit of item 5)

Add the following note to figure 6:

NOTE – The left V-network is not necessary when the EUT is battery-operated The right V-network may protect the meter against pulses in the dummy fence

Replace the existing title of figure 6 by the following new title:

Figure 6 – Arrangement for measurement of disturbance voltage produced at the fence terminal of electric fence energizers (see 7.3.7.2)

(*Continued from second cover*)

The concerned Technical Committee responsible for the preparation of this standard has reviewed the provisions of the following International Publications and has decided that they are acceptable for use in conjunction with this standard :

> IEC 60335-2-76 : 1997 Safety of household and similar electrical appliances — Part 2 : Particular requirements electric fence energizers

Only the English language text of the International Standard has been retained except figures while adopting it in this Indian Standard.

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LIMITS AND METHODS OF MEASUREMENT OF RADIO DISTURBANCE CHARACTERISTICS

PART 2 ELECTRICAL MOTOR-OPERATED AND THERMAL APPLIANCES FOR HOUSEHOLD AND SIMILAR PURPOSES, ELECTRIC TOOLS AND ELECTRIC APPARATUS

(First Revision)

1 Scope

1.1 This standard applies to the conduction and the radiation of radio-frequency disturbances from appliances whose main functions are performed by motors and switching or regulating devices, unless the r.f. energy is intentionally generated or intended for illumination.

It includes such equipment as: household electrical appliances, electric tools, regulating controls using semiconductor devices, motor-driven electro-medical apparatus, electric toys, automatic dispensing machines as well as cine or slide projectors.

Also included in the scope of this standard are:

- separate parts of the above mentioned equipment such as motors, switching devices e.g. (power or protective) relays, however no emission requirements apply unless formulated in this standard.

This standard gives for the time being no requirements for apparatus that cannot be measured on a test site; requirements for *in situ* measurements are under consideration.

Requirements concerning immunity are under consideration.

Excluded from the scope of this standard are:

- apparatus for which all emission requirements in the radio frequency range are explicitly formulated in other IEC or CISPR standards;

NOTE - Examples are.

- *Luminaires, discharge lamps and other lighting devices*. CISPR 15;
- *Audio and video equipment and electronic music instruments*. CISPR 13 and 20 (see also 7.3.5 4.2);
- *Mains communication devices:* IEC XX (to be published);
- *Equipment for generating and use of radio frequency energy for heating and therapeutic purposes*· CISPR 11;
- *Microwave ovens:* CISPR 11 (but be aware of subclause 1.3 on multifunction equipment),
- *Information technology equipment, e.g. home computers, personal computers:* CISPR 22;
- *Electric equipment to be used on motor vehicles:* CISPR 12.

- regulating controls and equipment with regulating controls incorporating semiconductor devices with a rated input current of more than 25 A per phase;
- stand-alone power supplies.

1.2 The frequency range covered is 9 kHz to 400 GHz.

1.3 Multifunction equipment which is subjected simultaneously to different clauses of this standard and/or other standards shall meet the provisions of each clause/standard with the relevant functions in operation; details are given in 7.2.1.

1.4 The limits in this standard have been determined on a probabilistic basis, to keep the suppression of disturbances economically feasible while still achieving an adequate radio protection. In exceptional cases radio frequency interference may occur, in spite of compliance with the limits. In such a case, additional provisions may be required.

2 Normative references

The following standards are referred to in this publication.

IEC 50(161): 1989, *International Electrotechnical Vocabulary – Chapter 161: Electromagnetic Compatibility*

CISPR 16: 1987, *CISPR Specification for radio interference measuring apparatus and measuring methods*

CISPR 16-1: *Specification for radio interference and immunity measuring equipment, Part 1 (Draft 1989)*

CISPR 16-2: *Methods of interference and immunity measurements, Part 2 (Draft 1989)*

NOTE - CISPR 16 (1987) shall be used until CISPR 16-1 and CISPR 16-2 are available

3 Definitions

3.1.1 For the purpose of this standard, the definitions contained in IEC 50(161): 1989, *International Electrotechnical Vocabulary (IEV) – Chapter 161: Electromagnetic Compatibility*, apply extended with the specific definitions in the field of discontinuous disturbance given in 3.2 to 3.7.

3.1.2 Definitions of the following terms are specified in CISPR 16, Part 1 and Part 2 (Draft 1989):

- Asymmetric voltage
- Electrical charge time constant
- Electrical discharge time constant
- Equipment under test (EUT)
- Level
- Radio frequency disturbance source
- Reference ground
- RFD current
- RFD power on conductors
- RFD voltage
- Type testing
- Weighting

3.2 **click:** A disturbance which exceeds the limit of continuous disturbance not longer than 200 ms and which is separated from a subsequent disturbance by at least 200 ms. Both intervals are related to the level of the limit of continuous disturbance.

A click may contain a number of impulses; in which case the relevant time is that from the beginning of the first to the end of the last impulse (see figure 3).

3.3 **switching operation:** One opening or one closing of a switch or contact.

NOTE - Independent of whether clicks are observed or not.

3.4 **minimum observation time** T: The minimum time necessary when counting clicks (or where relevant counting switching operations) to provide sufficiently firm evidence for the statistical interpretation of the number of clicks (or switching operations) per time unit (see also 7.4.2.1).

3.5 **click rate** N: In general the number of clicks or switching operations within one minute; this figure is being used to determine the click limit (see also 7.4.2.3).

3.6 **click limit** L_q: The relevant limit L for continuous disturbance, as given in 4.1.1 for the measurement with the quasi-peak detector, increased by a certain value determined from the click rate N (see also 4.2.2.2).

The click limit applies to the disturbance assessed according to the upper quartile method.

3.7 **upper quartile method:** A quarter of the number of the clicks registered during the observation time T is allowed to exceed the click limit L_q.

In the case of switching operations a quarter of the number of the switching operations registered during the observation time is allowed to produce clicks exceeding the click limit L_q (see also 7.4.2.6).

4 Limits of disturbance

Radio disturbance measurements below 148,5 kHz and above 300 MHz need not to be carried out, unless otherwise specified in this standard for specific appliances.

4.1 *Continuous disturbance*

Commutator motors, as well as other devices incorporated in household appliances, electric tools and similar electrical apparatus may cause continuous disturbance.

Continuous disturbance may be either broadband, caused by switching devices such as mechanical switches, commutators and semiconductor regulators, or may be narrowband, caused by electronic control devices such as microprocessors.

NOTE - Instead of the concept of "broadband" and "narrowband" disturbances, in this standard a distinction is made between two related kinds of disturbance, defined by the type of the applied detector. For this purpose limits have been defined with respect to the measurement with the quasi-peak detector and with the average detector (see 5 1.1 and 6.1 1)

4.1.1 *Frequency range 148,5 kHz to 30 MHz (terminal voltages)*

NOTE - The World Administrative Radiocommunications Conference (WARC) has in 1979 reduced the lower frequency limit in Region 1 to 148,5 kHz; for applications falling in the scope of this standard, tests at 150 kHz are considered adequate, since 148,5 kHz falls within the receiver bandwidth

The limits of the terminal disturbance voltages are given in table 1. Terminal voltages are measured, in accordance with clause 5, on each terminal with respect to ground.

Terminals are defined as conductive parts, suitable for re-usable electrical connection to external circuits.

4.1.1.1 The limits in columns 2 and 3 shall be met on the phase(s) and the neutral of the mains terminals of all appliances except those of electric tools.

4.1.1.2 On additional terminals of appliances as well as on load and additional terminals of regulating controls incorporating semiconductor devices the relaxed limits given for "additional terminals" in columns 4 and 5 apply.

Terminals which may be used as either mains terminals or load/additional terminals are subject to the limits for mains terminals.

No terminal voltage limits apply for non-rewirable leads shorter than 2 m, connecting separate semiconductor speed controls with apparatus such as sewing machines, dental drills, etc. The semiconductor device may be either incorporated in the separate control unit or in the apparatus.

NOTE - For the measurement at the load terminals and additional terminals of regulating controls incorporating semiconductor devices see 5.2.4, for additional terminals of other appliances see 5.2.3.

4.1.1.3 For the mains terminals of electric tools the particular limits given in columns 6 to 11 apply according to the rated power of the motor, the power of any heating device is to be excluded (for instance heating power in a blower for plastic welding). For the load terminals and additional terminals of electric tools, columns 4 and 5 apply without further relaxation.

Table 1 – Terminal voltage limits for the frequency range 148,5 kHz to 30 MHz *(see figures 1 and 2)*

HOUSEHOLD APPLIANCES AND EQUIPMENT CAUSING SIMILAR DISTURBANCES AND REGULATING CONTROLS INCORPORATING SEMICONDUCTOR DEVICES

Frequency range	At mains terminals		At load terminals and at additional terminals	
1	2	3	4	5
(MHz)	dB (µV) Quasi-peak	dB (µV) Average*	dB (µV) Quasi-peak	dB (µV) Average*
0,15 to 0,50	Decreasing linearly with the logarithm of the frequency from: 66 to 56	59 to 46	80	70
0,50 to 5	56	46	74	64
5 to 30	60	50	74	64

MAINS TERMINALS OF TOOLS

1	6	7	8	9	10	11
Frequency range	Rated motor power not exceeding 700 W		Rated motor power above 700 W and not exceeding 1 000 W		Rated motor power above 1 000 W	
(MHz)	dB (µV) Quasi-peak	dB (µV) Average*	dB (µV) Quasi-peak	dB (µV) Average*	dB (µV) Quasi-peak	dB (µV) Average*
0,15 to 0,35	*Decreasing linearly with the logarithm of the frequency from* 66 to 59	59 to 49	70 to 63	63 to 53	76 to 69	69 to 59
0,35 to 5	59	49	63	53	69	59
5 to 30	64	54	68	58	74	64

* If the limit for the measurement with the average detector is met when using a receiver with a quasi-peak detector, the equipment under test shall be deemed to meet both limits and the measurement using the receiver with an average detector need not to be carried out.

NOTE - The limits for the measurement with the average detector are tentative and may be modified after a period of experience

4.1.1.4 For battery operated appliances (with built-in batteries, as well as with external batteries) which can be connected to the mains the limits of columns 2 and 3 of table 1 apply to the mains terminals.

No radio disturbance limits apply to appliances with built-in batteries, which cannot be connected to the mains supply.

No radio disturbance limits apply to appliances with external batteries, if the connecting lead between appliance and battery is shorter than 2 m. If the connecting lead is longer than 2 m or easily extendable by the user without special tools, then the limits of columns 4 and 5 of table 1 apply to these leads.

4.1.2 *Frequency range 30 MHz to 300 MHz (disturbance power)*

The limits of the disturbance power are given in table 2.

Disturbance power is measured in accordance with clause 6, at all terminals.

Table 2 – Disturbance power limits for the frequency range 30 MHz to 300 MHz

	Household and Similar appliances		Tools					
1	2	3	4	5	6	7	8	9
Frequency range			Rated motor power not exceeding 700 W		Rated motor power above 700 W and not exceeding 1 000 W		Rated motor power above 1 000 W	
(MHz)	dB (pW) Quasi-peak	dB (pW) Average*	dB (pW) Quasi-peak	dB (pW) Average*	dB (pW) Quasi-peak	dB (pW) Average*	dB (pW) Quasi-peak	dB (pW) Average*
30 to 300	Increasing linearly with the frequency from		Increasing linearly with the frequency from		Increasing linearly with the frequency from		Increasing linearly with the frequency from	
	45 to 55	35 to 45	45 to 55	35 to 45	49 to 59	39 to 49	55 to 65	45 to 55

* If the limit for the measurement with the average detector is met when using a receiver with a quasi-peak detector, the equipment under test shall be deemed to meet both limits and the measurement with the receiver with average detector need not be carried out.

NOTE - The limits for the measurement with the average detector are tentative and may be modified after a period of experience

4.1.2.1 *The limits in columns 2 and 3 of table 2 shall be met by all appliances except* those mentioned in 4.1.2.2, second paragraph, to 4.1.2.4.

4.1.2.2 For battery operated appliances (with built-in batteries as well as with external batteries) which can be connected to the mains the limits of columns 2 and 3 of table 2 apply, together with 4.1.2.3 and 4.1.2.4.

For battery operated appliances (with built-in batteries) which cannot be connected to the mains, no disturbance power limits apply.

4.1.2.3 For electric tools the particular limits given in columns 4 to 9 of table 2 apply according to the rated power of the motor, the power of any heating device is to be excluded (for instance heating power in a blower for plastic welding).

4.1.2.4 Regulating controls which incorporate semiconductor devices, rectifiers, battery chargers and convertors are not subject to the disturbance power limits in the frequency range 30 MHz to 300 MHz.

4.2 *Discontinuous disturbance*

Switching operations in thermostatically controlled appliances, automatic programme controlled machines and other electrically controlled or operated appliances generate discontinuous disturbance. The subjective effect of discontinuous disturbance varies with repetition rate and amplitude in audio and video presentation. Therefore distinction is made between various kinds of discontinuous disturbance.

The discontinuous disturbance is only measured with a measuring receiver including a quasi-peak detector as mentioned in 5.1.1 and specified in clause 2 of CISPR 16, Part 1 (Draft 1989).

See annex C for guidance.

4.2.1 The limits for discontinuous disturbance depend mainly on the character of the disturbance and on the click rate *N* as given in detail in 4.2.2 and 4.2.3.

No discontinuous disturbance limits apply in the frequency range 30 MHz to 300 MHz.

NOTE - The level of disturbances below 30 MHz is interpreted as an indication for the level above 30 MHz

4.2.2 *Frequency range 148,5 kHz to 30 MHz (terminal voltages)*

4.2.2.1 The limits of table 1 apply also to discontinuous disturbances from all equipment which produce:

a) disturbances other than clicks, or

b) clicks occurring more frequently than twice in any 2 s period, or

c) clicks with a click rate *N* equal to or greater than 30.

Appliances as described in 4.2.3 are exempted.

NOTE - Examples of discontinuous disturbances for which the limits for continuous disturbance apply are shown in figures 4a, 4b, and 4c

4.2.2.2 The click limit L_q is the relevant limit L for continuous disturbance, as given in 4.1.1, increased by:

44 dB	for $N < 0,2$, or
20 lg (30/*N*) dB	for $0,2 \le N < 30$

NOTE - Examples of discontinuous disturbances which are classified as clicks are shown in figures 3a, 3b and 3c.

See also annex A, table A.1 and table A.2.

4.2.2.3 The click limit L_q applies for click rates *N* determined under operating conditions and interpretation of results as specified in clause 7.

4.2.3 The following exceptions apply:

4.2.3.1 *Thermostats for, or integrated in room heating equipment (such as convectors,* fan heaters, fluid filled heaters, oil burners and similar) which are intended for stationary use shall be in conformity with the click limit L_q, for which in the calculation a click rate N shall be used, which is five times the click rate N determined for a single room-heater in accordance with 7.2.4. Subclause 4.2.3.4 does not apply.

4.2.3.2 When clicks from programme-controlled appliances are evaluated applying the method of assessment of discontinuous disturbance, some discontinuous disturbance may be registered that does not satisfy the conditions given in 4.2.2.1 necessary in order to be classified as clicks.

If the total duration of this discontinuous disturbance does not exceed 600 ms during the minimum observation time (see 3.4), it is considered as one click and is not subject to the limits for continuous disturbance laid down in 4.1.1.

4.2.3.3 The disturbance from individual switching operations, caused directly or indirectly, manually or by similar activities on a switch or a control which is included in an appliance or otherwise to be used for:

1) *the purpose of mains connection or disconnection only,*
2) the purpose of programme selection only,
3) the control of energy or speed by switching between a limited number of fixed positions.
4) the changing of the manual setting of a continuously adjustable control such as a variable speed device for water extraction or electronic thermostats, is to be disregarded for the purpose of testing the appliance for compliance with the limits of radio disturbance set out in this standard.

Examples of switches included in this subclause are the switch for a lamp (including foot activated), the switch for an electric typewriter, manual switches for heat and air flow control in fan heaters and hair-dryers, as well as the indirectly operated switch in a cupboard, wardrobe or refrigerator, and sensor-operated switches for front door lamps, etc.

Switches which usually will be repeatedly operated are not included in this subclause, *e.g. for sewing machines, calculating machines, soldering equipment, etc.* see 7.2.3. and 7.3.2.4 c.

Also the disturbance caused by the operation of any switching device or control which is included in an appliance for the purpose of mains disconnection for safety only, is to be disregarded for the purpose of testing the appliance for compliance with the limits of radio disturbance as described in this standard.

4.2.3.4 Appliances which have a click rate *N* of not more than five and which have instantaneous switching (i.e. the duration of each click is less than 10 ms) shall be deemed to comply with the limits, independent of the amplitude of the clicks (see for tables A.1 and A.2 of annex A).

If either condition is not satisfied then the limits in accordance with 4.2.2 apply.

4.2.3.5 For appliances which have a click rate *N* of less than five, any two disturbances caused by the sequential operation of two or more separate switches, and each disturbance having a maximum duration of 200 ms, and neither preceded nor followed within 2 s by any other disturbance, shall be evaluated as two clicks even when the separation between the disturbances is less than 200 ms.

For this class of equipment, for instance refrigerators, the example shown in figure 4c, would be evaluated as two clicks and not as continuous disturbance.

4.2.3.6 For thermostatically controlled three-phase switches, the three disturbances caused sequentially in each of the three phases and the neutral shall, independent of their spacing and subject to the following conditions, be evaluated as three clicks and not as continuous disturbance·

a) the switch operates not more than once in any 15 min period and the three disturbances are neither preceded nor followed within 2 s by any other disturbance;

b) the duration of the disturbance caused by the opening or the closing of any one of the contacts shall be 10 ms or less and not more than a quarter of the number of the clicks caused by switching operations registered during the observation time is allowed to exceed the level 44 dB above the relevant limit *L* for continuous disturbance.

4.2.3.7 For appliances listed in table A.2 of annex A, the click rate $N = n_2 \times f/T$, where n_2 is the number of switching operations (see 3.3) during the observation time *T* minutes, and *f* is a factor given in annex A, table A.2.

4.2.3.8 The limits for electric fence supply units apply to the mains terminals and to the output terminal of the supply unit. A correction factor of 16 dB has to be added to the measured values on the output terminals according to the voltage division resulting from the use of the fence equivalent circuit from the 250 Ω resistor in series with the 50 Ω impedance of the artificial mains V-network (see also item 5 of the legend of figure 6).

4.2.4 The limits for specific appliances for various conditions in accordance with the preceding 4.2.2 and 4.2.3 are summarized in annex A.

Limits for appliances not shown in annex A shall be calculated in accordance with the principles laid down in 4.2.2 and 4.2.3, using the examples shown in annex A for guidance.

5 Methods of measurement of terminal disturbance voltages (148,5 kHz to 30 MHz)

This clause lays down the general requirements for the measurement of disturbance voltage produced at the terminals of apparatus

The operating conditions are given in clause 7 of this standard.

5.1 *Measuring devices*

The measuring devices given below are to be used:

5.1.1 *Measuring receivers*

Receivers with quasi-peak detectors shall be in accordance with clause 2 of CISPR 16, Part 1 (Draft 1989); receivers with average detectors shall be in accordance with clause 4 of CISPR 16, Part 1 (Draft 1989).

NOTE - Both detectors may be incorporated in a single receiver and measurements carried out either using the quasi-peak detector or the average detector.

5.1.2 *Artificial mains network*

The artificial mains V-network is required to provide a defined impedance at high frequencies between the terminals of the equipment under test and reference ground, and also to isolate the test circuit from unwanted radio-frequency signals on the supply mains.

The artificial mains V-network 50 Ω/50 µH (or 50 Ω/50 µH + 5 Ω) as defined in clause 11 of CISPR 16, Part 1 (Draft 1989) shall be used.

To ensure that, at the frequency of measurement, the impedance of the mains does not materially affect the impedance of the artificial mains V-network, a suitable radio-frequency impedance shall be inserted between the artificial mains V-network and the supply mains. This impedance will also reduce the effect of unwanted signals which occur on the supply mains (see also 5.3)

The connection between the artificial mains V-network and the measuring receiver shall be made by means of a coaxial cable with a characteristic impedance of 50 Ω.

5.1.3 *Voltage probe*

The voltage probe shall be used when measuring on terminals other than mains terminals (see 5.2.3.2) e.g. load and control terminals (5.2.4.4). The voltage probe shall also be used on mains terminals when the artificial mains V-network cannot be used without unduly influencing the equipment under test or the test equipment, e.g. while measuring motors and heating devices operating at more than 25 A per phase.

The voltage probe contains a resistor having a resistance value of at least 1 500 Ω in series with a capacitor with a reactive value negligible to the resistance (in the range 150 kHz to 30 MHz) (see clause 12 of CISPR 16, Part 1, Draft 1989).

The measuring results shall be corrected according to the voltage division between the probe and the measuring set. For this correction only the resistive parts of the impedances shall be taken into account.

If the function of the equipment under test is affected by the impedance of the probe being too low, its impedance (at 50/60 Hz and at radio frequencies) shall be increased as needed (for example 15 kΩ in series with 500 pF).

5.1.4 *Artificial hand*

In order to simulate the influence of the user's hand, application of the artificial hand is required for hand held equipment during the disturbance voltage measurement.

The artificial hand consists of metal foil which is connected to one terminal (terminal M) of an RC element consisting of a capacitor of 220 pF ± 20 % in series with a resistor of 510 Ω ± 10 % (see figure 8a); the other terminal of the RC element shall be connected to the reference ground of the measuring system (see CISPR 16, Part 1, Draft 1989). The RC element of the artificial hand may be incorporated in the housing of the artificial mains network.

5.1.5 *Disturbance analyzer for discontinuous disturbance*

The measuring equipment for discontinuous disturbance shall comply with clause 14 of CISPR 16, Part 1 (Draft 1989). An alternative method using an oscilloscope may be applied provided that the degree of accuracy is sufficient.

For the measurement of the duration of the disturbance see CISPR 16, Part 1 (Draft 1989).

5.2 *Measuring procedures and arrangements*

5.2.1 *Arrangement of the leads of the equipment under test*

NOTE - Clause 3 and annex A of CISPR 16, Part 2 give more information about the connection of the electrical appliances to the measuring equipment.

5.2.1.1 *Mains lead*

During all measurements of disturbance terminal voltages (on the mains terminals or on other terminals) the artificial mains V-network is connected to the mains terminals in order to provide a defined termination. As described in detail in 5.2.2 the V-network is situated at a distance of 0,8 m from the appliance.

The disturbance voltage measurements are normally to be made at the plug end of the lead.

If the mains lead of the appliance under test is longer than necessary to be connected to the V-network the length of this lead in excess of 0,8 m shall be folded back and forth parallel to the lead so as to form a horizontal bundle with a length between 0,3 m and 0,4 m. In the case of controversy with regard to the banning of sales or withdrawal of a type approval it may be replaced by a lead of similar quality with a length of 1 m.

If the lead on which the measurements are to be made is shorter than the required distance between the appliance and the mains V-network, it shall be extended to the necessary length.

If the mains lead of the appliance under test includes the earthing conductor, the plug end of the earthing conductor shall be connected to the reference ground of the measuring equipment.

Where an earthing conductor is required, but is not included in the lead, the connection of the earth terminal of the appliance to the reference ground of the measuring equipment shall be made by a lead not longer than necessary to be connected to the V-network running parallel to the mains lead at a distance of not more than 0,1 m from it.

If the appliance is not supplied with a lead it is to be connected to the artificial mains V-network by a lead not longer than 1 m (also in case of plug or socket outlet).

5.2.1.2 *Other leads*

The lead connecting the appliance with an auxiliary apparatus and the leads to regulating controls or to batteries of battery-powered appliances shall be treated in accordance with 5.2.1.1 except where otherwise stated in this standard.

5.2.2 *Disposition of appliances under test and their connection to the artificial mains V-network*

5.2.2.1 *Appliances normally operated without an earth connection and not held in the hand*

The appliance shall be placed 0,4 m above an earthed conducting surface of at least 2 m × 2 m in size and at a distance of 0,8 m from the artificial mains V-network and shall be kept at least 0,8 m from any other earthed conducting surface. If the measurements are made in a screened enclosure, the distance of 0,4 m may be referred to one of the walls of the enclosure.

5.2.2.2 *Handheld appliances which are normally operated without an earth connection*

Measurements shall first be made in accordance with 5.2.2.1.

Additional measurements shall then be made using the artificial hand described in 5.1.4.

The general principle to be followed in the application of the artificial hand is that the metal foil shall be wrapped around all handles, both fixed and detachable, supplied with the appliance and the terminal M shall additionally be connected to any exposed non-rotating metalwork as specified in 5.2.2.2.2 to 5.2.2.2.4.

Metalwork which is covered with paint or lacquer is considered as exposed metalwork and shall be directly connected to the terminal M of the RC element.

The artificial hand is to be applied the following way:

5.2.2.2.1 When the casing of the appliance is entirely of metal, no metal foil is needed, but the terminal M of the RC element shall be connected directly to the body of the appliance.

5.2.2.2.2 When the casing of the appliance is of insulating material, metal foil shall be wrapped round the handles, e.g. in figure 8b, around handle B, and also round the second handle D, if present. Also metal foil 60 mm wide shall be wrapped round the body C at that point where the iron core of the motor stator is located, or around the gearbox if this gives a higher disturbance level. All these pieces of metal foil, and the ring or bushing A, if present, shall be connected together and to the terminal M of the RC element.

5.2.2.2.3 When the casing of the appliance is partly metal and partly insulating material, and has insulating handles, metal foil shall be wrapped round the handles, as handles B and D in figure 8b. If the case is non-metallic at the location of the motor, a metal foil 60 mm wide shall be wrapped round the body C at that point where the iron core of the motor stator is located, or alternatively around the gearbox, if this is of insulating material and a higher disturbance level is obtained. The metal part of the body, the point A, the metal foil round the handles B and D and the metal foil on the body C shall be connected together and to the terminal M of the RC element.

5.2.2.2.4 When a class II appliance has two handles of insulating material A and B and a case of metal C, for example an electric saw (figure 8c), metal foil shall be wrapped round the handles A and B. The metal foil at A and B and the metal body C shall be connected together and to the terminal M of the RC element.

NOTE - Classes 0, 0I, II and III according to IEC Standard 536 *Classification of electrical and electronic equipment with regard to protection against electric shock*

5.2.2.3 *Appliances normally required to be operated with an earth connection*

The appliance shall be placed at a distance of 0,8 m from the artificial mains V-network, the disturbance voltages to be measured in accordance with 5.2.1.

The measurements shall be made with the earth terminal of the appliance connected to the reference ground of the measuring equipment.

If the appliance is not supplied with a lead the connection of the earth terminal of the appliance to the reference ground of the measuring equipment shall be made by a lead running parallel to the mains lead and of the same length and at a distance of not more than 0,1 m from it.

If the enclosure of the appliance is of non-conducting material, the appliance shall be tested as described in 5.2.2.1.

5.2.3 *Appliances having auxiliary apparatus connected at the end of a lead other than the mains lead*

NOTES

1 Regulating controls incorporating semiconductor devices are excluded from this subclause, as these are covered in 5.2 4

2 When the auxiliary apparatus is not essential to the operation of the appliance and has a separate test procedure specified elsewhere in this standard (e g power nozzle of a vacuum cleaner) this subclause does not apply. The main appliance is tested as an individual appliance.

Connecting leads exceeding 1 m in length are arranged in accordance with 5.2.1.1.

Measurements need not to be made when the connecting lead between the appliance and the auxiliary apparatus is permanently fixed at both ends, and is either shorter than 2 m, or if it has a shielding whose ends are connected to the metal housing of the appliance and that of the auxiliary apparatus.

5.2.3.1 *Measuring arrangement*

The equipment under test shall be arranged in accordance with 5.2.2 with the following additional requirements:

a) The auxiliary apparatus shall be placed at the same height and distance from the earthed conducting surface as the main appliance, and if the auxiliary lead is long enough, at a distance of 0,8 m from the main appliance, 5.2.1.1 shall be observed.

If the auxiliary lead is shorter than 0,8 m, the auxiliary apparatus shall be placed at the longest possible distance from the main apparatus.

If the auxiliary lead is longer than 0,8 m, the length of the auxiliary lead in excess of 0,8 m shall be folded parallel to itself so as to form a horizontal bundle with a length between 0,3 m and 0,4 m.

The auxiliary lead is stretched in the opposite direction to the mains lead.

When the auxiliary apparatus contains controls, the arrangements for its operation must not unduly affect the level of disturbance;

b) If an appliance having an auxiliary apparatus is earthed, no artificial hand shall be connected. If the appliance itself is made to be held in the hand, the artificial hand shall be connected to the appliance and not to any auxiliary apparatus;

c) If the appliance is not made to be held in the hand, the auxiliary apparatus which is not earthed and is made to be held in the hand shall be connected to the artificial hand; if the auxiliary apparatus is not made to be held in the hand either, it shall be placed above an earthed conducting surface as described in 5.2.2.1.

5.2.3.2 *Measuring procedure*

In addition to the measurement on the terminals for the mains connection, measurements are conducted on all other terminals for incoming and outgoing leads (e.g. control and load lines) using a probe as described in 5.1.3 in series with the input of the measuring receiver.

The auxiliary apparatus, control or load is connected to allow measurements to be made under all provided operating conditions and during interactions between the appliance and the auxiliary apparatus.

Measurements are performed both on the terminals of the appliance and on those of the auxiliary apparatus.

5.2.4 *Regulating controls incorporating semiconductor devices*

5.2.4.1 The regulating control shall be arranged as shown in figure 5. The output terminal of the control shall be connected to a load of the correct rated value by leads of 0,5 m to 1 m length.

Unless otherwise specified by the manufacturer, the load shall consist of incandescent lamps.

5.2.4.2 When a regulating control or its load is to be operated with an earth connection (i.e. Class I equipment) then the earth terminal of the regulating control shall be connected to the earth terminal of the artificial mains V-network. The earth terminal of the load, if any, is connected to the earth terminal of the regulating control, or, if not available, directly to the earth terminal of the artificial mains V-network.

5.2.4.3 The control shall first be measured in accordance with the provisions of 5.2.2.1 or 5.2.2.3.

5.2.4.4 Secondly, measurement of the disturbance voltage is made at the load terminals using a probe as described in 5.1.3 in series with the input of the measuring receiver.

5.2.4.5 For regulating controls having additional terminals for connection to a remote sensor or control unit, the following further provisions apply:

a) *The additional terminals shall be connected to the remote sensor or control unit* by leads of 0,5 m to 1 m length. If a special lead is provided, the length of this lead in excess of 0,8 m shall be folded back and forth parallel to the lead so as to form a horizontal bundle with a length between 0,3 m and 0,4 m.

b) Measurement of the disturbance voltage at the additional terminals of the regulating control shall be carried out in the same way as described in 5.2.4.4 for the load terminals.

5.3 *Reduction of disturbance not produced by the equipment under test*

Any measurable disturbance voltage not caused by the equipment under test (arising from the supply mains or produced by extraneous fields), shall give an indication on the measuring set at least 20 dB below the lowest voltage to which it is desired to measure.

Should the background noise not be at least 20 dB below the measurement level, it should be quoted in the results of measurement.

The disturbance voltages not caused by the equipment to be tested are measured when the equipment under test is connected but not operated.

NOTE - Realization of this condition may require the addition of a supplementary filter in the supply mains and the measurements may have to be made in a screened enclosure.

6 Methods of measurement of disturbance power (30 MHz to 300 MHz)

This clause lays down the general requirements for the measurement of disturbance power produced at the terminals of apparatus

The operating conditions are given in clause 7 of this standard.

It is generally considered that for frequencies above 30 MHz the disturbing energy is propagated by radiation to the disturbed apparatus.

Experience has shown that the disturbing energy is mostly radiated by the part of the mains leads and other leads near the appliance. It is therefore agreed to define the disturbing capability of an appliance as the power it could supply to its leads. This power is nearly equal to that supplied by the appliance to a suitable absorbing device placed around these leads at the position where the absorbed power is at its maximum.

Calibration is accomplished in accordance with annex I of CISPR 16, Part 1 (Draft 1989).

6.1 *Measuring devices*

6.1.1 *Measuring receivers*

Receivers with quasi-peak detectors shall be in accordance with clause 2 of CISPR 16, Part 1 (Draft 1989); receivers with average detectors shall be in accordance with clause 4 of CISPR 16, Part 1 (Draft 1989).

NOTE - Both detectors may be incorporated in a single receiver and measurements carried out either using the quasi-peak detector or the average detector.

6.1.2 *Absorbing clamp*

The absorbing clamp shall be in accordance with clause 13 of CISPR 16, Part 1 (Draft 1989).

6.2 *Measurement procedure on the mains lead*

6.2.1 The appliance to be tested is placed on a non-metallic table at least 0,4 m from other metallic objects and the lead to be measured on is stretched in a straight line for a distance sufficient to accommodate the absorbing clamp, and to permit the necessary measuring adjustment of position for tuning. The clamp is placed around the lead so as to measure a quantity proportional to the disturbance power on the lead.

6.2.2 The absorbing clamp is positioned for maximum indication at each test frequency: the clamp shall be moved along the lead until the maximum value is found between a position adjacent to the appliance and a distance of about a half-wavelength from it.

NOTE - The maximum may occur at a distance close to the appliance.

6.2.3 The straight portion of the lead to be measured on should therefore be about 6 m long, this being equal to $\lambda_{max}/2$ + 0,6 m in order to allow at any time the positioning of the absorbing clamp and a possible second clamp for additional isolation.

If the original lead of the appliance is shorter than the necessary length it shall be extended or replaced by a similar lead.

Any plug or socket which will not pass through the absorbing clamp due to its size shall be removed or, especially in the case of controversy with regard to the banning of sales or withdrawal of a type approval the lead may be replaced by a lead of similar quality with the necessary length.

NOTE - λ_{max} is the wavelength corresponding to the lowest frequency at which measurements are to be made for instance 10 m at 30 MHz

6.2.4 If the r.f. isolation between mains supply and the input of the absorbing clamp on the side of the appliance appears to be insufficient, a fixed ferrite absorber (see CISPR 16, Part 1, Draft 1989) should be placed along the lead at a distance of about 6 m from the appliance. This improves the stability of the loading impedance and reduces extraneous noise coming from the mains supply. For more information see clause 13 of CISPR 16, Part 1, Draft 1989.

6.3 *Special requirements for appliances having auxiliary apparatus connected at the end of a lead other than the mains lead*

6.3.1 *Measuring arrangement*

6.3.1.1 Auxiliary leads normally extendable by the user, for instance with a loose end, or leads fitted with a plug or socket on one or both ends shall in accordance with 6.2.3 be extended to a length of about 6 m.

Any plug or socket which will not pass through the absorbing clamp due to its size shall be removed (see 6.2.3).

6.3.1.2 If the auxiliary lead is permanently fixed to the appliance and to the auxiliary apparatus and:

- is shorter than 0,25 m, measurement are not to be made on these leads;
- is longer than 0,25 m but shorter than twice the length of the absorbing clamp, it shall be extended to twice the length of the absorbing clamp;
- is longer than twice the length of the absorbing clamp, measurements shall be made using the original lead.

When the auxiliary apparatus is not necessary for the operation of the main appliance (e.g. a power nozzle to a vacuum cleaner) and a separate test procedure for the auxiliary apparatus is specified elsewhere in this standard, only the lead, but not the auxiliary apparatus, shall be connected. (However, all measurements on the main appliance in accordance with 6.3.2 are to be made.)

6.3.2 *Measurement procedure*

6.3.2.1 Measurement of the disturbance power is made firstly on the mains lead of the main appliance using the absorbing clamp in accordance with 6.2. Any lead connecting the main appliance to an auxiliary apparatus is disconnected if this does not affect the operation of the appliance, or is isolated by means of ferrite rings (or an absorbing clamp) close to the appliance.

6.3.2.2 Secondly, a similar measurement is made on each lead which is or may be connected to an auxiliary apparatus, whether or not it is necessary for the operation of the appliance; the current transformer of the clamp pointing towards the main appliance. Isolation, or disconnection of the mains lead and other leads is made in accordance with 6.3.2.1.

NOTE - For short, permanently connected leads the movement of the clamp (as described in 6.2.3) is limited by the length of the lead

6.3.2.3 In addition, measurement is made as above but with the current transformer of the clamp pointing towards any auxiliary apparatus, unless this auxiliary apparatus is not needed for the operation of the main appliance and a separate test procedure for it is specified elsewhere (no disconnection or r.f. isolation of other leads is of course necessary in this case).

6.4 *Assessment of measuring results*

The measured power is derived from the maximum indicated value found at each frequency of measurement and the calibration curve of the absorbing clamp (see also the example given in annex I of CISPR 16, Part 1 (Draft 1989).

7 Operating conditions and interpretation of results

When measurements of disturbance are being made, the appliance shall be operated under the following conditions:

7.1 *General*

7.1.1 Normal load conditions shall be as defined in subclauses 7.2 and 7.3, unless these are in conflict with the manufacturer's instruction for use, which in such cases take precedence. Where appliances are not covered by these subclauses, the manufacturer's instruction for use shall be followed.

7.1.2 The duration of operation is not restricted unless the appliance is marked accordingly. In this case the limitations shall be complied with.

7.1.3 No running-in time to be specified but, prior to testing, the appliance shall be operated for a sufficient period to ensure that the conditions of operation will be typical of those during normal life of the equipment. Running-in of motors shall be carried out by the manufacturer.

7.1.4 The appliances shall be operated from a supply which provides the rated voltage and the rated frequency of the appliance.

A test at about 160 kHz and at about 50 MHz shall be made over a range of 0,9 to 1,1 times the rated voltage whether the level of disturbance varies considerably with the supply voltage; in which case the measurements are to be made at the voltage which causes maximum disturbance.

Appliances with more than one rated voltage shall be tested at the rated voltage which causes maximum disturbance.

7.1.5 Speed controls with a limited number of fixed positions are to be adjusted to approximately average and to maximum speed, the higher reading to be registered if there is no instruction to the contrary in this standard.

Apparatus which incorporate electronic regulating controls shall have the controls adjusted for maximum disturbance in accordance with the procedure outlined in 7.2.5.1, in both frequency ranges 148,5 kHz to 30 MHz and 30 MHz to 300 MHz.

If the setting of continuously adjustable controls, which are not designed for frequent adjustment in normal use, has been pre-set, it shall not be adjusted during the test.

7.1.6 The ambient temperature shall lie within the range 15 °C to 35 °C.

7.2 *Operating conditions for particular equipment and integrated parts*

7.2.1 *Multifunction equipment*

Multifunction equipment which is subjected simultaneously to different clauses of this standard and/or other standards shall be tested with each function operated in isolation, if this can be achieved without modifying the equipment internally. The equipment thus tested shall be deemed to have complied with the requirements of all clauses/standards when each function has satisfied the requirements of the relevant clause/standard.

For equipment for which it is not practical to test with each function operated in isolation, or where the isolation of a particular function would result in the equipment being unable to fulfil its primary function, the equipment shall be deemed to have complied only if it meets the provisions of each clause/standard with the necessary functions operative.

7.2.2 *Battery operated equipment*

If the appliance can be connected to the mains it shall be tested operating in each permitted mode and in accordance with the operating conditions given in 7.3 while connected to the mains.

In the frequency range 148,5 kHz to 30 MHz measurements on equipment with external batteries are made at the terminals of the connecting lead using a probe as described in 5.1.3 in series with the input of the measuring receiver. Equipment which is made to be held in the hand shall be connected to the artificial hand.

In the frequency range 30 MHz to 300 MHz measurement on equipment with external batteries are made as described in 6.3.2.2 with the current transformer of the clamp pointing toward the appliance.

7.2.3 *Integrated starting switches, speed controls, etc*

For starters, speed controls etc. incorporated in appliances like sewing machines and similar apparatus given in table A.2 the second paragraph of 7.4.2.3 applies.

7.2.3.1 Starters and speed control of sewing machines and dental drills. To determine the disturbance generated during starting and stopping the speed of the motor shall be increased to maximum speed over a 5 s period. For stopping, the control shall be reset quickly to its off position. To determine the click rate *N*, the period between two starts shall be 15 s.

7.2.3.2 Starting switches in adding machines, calculating machines and cash registers shall be operated intermittently with at least 30 starts per minute. If 30 starts per minute cannot be attained, then intermittent operation with as many starts per minute as possible in practice shall be used.

7.2.3.3 Picture change devices of slide-projectors. To determine the click rate *N*, the device shall be operated with the lamp switched on and with four picture-changes per minute without slides.

7.2.4 *Thermostats*

Separate as well as incorporated thermostats for the control of electric room or water heaters, oil and gas burners and the like.

The click rate *N* shall be determined for the maximum operating rate stated by the manufacturer or – if sold for or together with a heater or burner – for a duty-cycle of (50 ± 10) % of this heater or burner.

The amplitude and duration of the disturbance shall be measured for the lowest rated current of the thermostat. For thermostats which have an acceleration resistor incorporated, the same measurements shall be performed in addition, without any separate heater connected.

When, in practice, the thermostat may be used together with inductive loads (e.g. relay, contactor) all measurements shall be performed using such a device, having the highest coil inductance used in practice.

In order to obtain a satisfactory measurement, it is essential that the contacts shall be operated for a sufficient number of times with a suitable load to ensure that the levels of disturbance are representative of those encountered in normal operation.

NOTES

1 For appliances containing thermostatically operated switches 7.3 4 is to be observed

2 If a thermostat is integrated in an appliance which it does not control, it is to be treated according to 7.2 4 or 7 3 4 14

3 See also 4 2.3 1 for thermostats for room heating equipment which are intended for stationary use.

7.2.5 *Regulating controls incorporating semiconductor devices*

NOTE - According to 4 1 2 4 these controls as such are not subject to the disturbance power limits in the frequency range 30 MHz to 300 MHz, see also 7 1.5

7.2.5.1 *Adjustments for maximum disturbance level*

The regulating control shall be adjusted to give a maximum indication on the meter at each frequency of measurement. After the value of the disturbance is registered at each preferred frequency (see 7.4.1.3) the frequency band adjacent to the preferred frequency is scanned without adjustment to the regulating control and the highest disturbance values are noted (for instance scan between 150 kHz and 240 kHz with the regulating control set at the value that gave the maximum on the meter at 160 kHz).

7.2.5.2 *Equipment with several regulating controls*

The following measurement procedure shall be applied to appliances containing several individually adjustable regulating controls each one having a maximum rated load current of not more than 25 A.

It shall be applied both on appliances where several regulating controls are connected to the same phase of the mains and to appliances where the regulating controls are connected to separate phases of the mains.

7.2.5.2.1 Each regulating control is tested separately. Measurements are made in accordance with 7.2.5.1 on all terminals of the appliance.

If separate switches are provided for the individual regulating controls, the units not being used should be switched off during these tests.

7.2.5.2.2 As many individual regulating controls as possible are connected to their loads without the maximum current per phase to the appliance exceeding 25 A when each of the controls is carrying its maximum rated current.

When not all individual controls can be connected to their maximum load, those controls are given priority which gave the highest disturbance values when tested in accordance with 7.2.5.2.1.

NOTE - The controls may be different for different frequencies or for different terminals

The setting of the individual controls shall be the same as those giving maximum disturbance during the measurement in accordance with 7.2.5.2.1. In addition a simple check shall be made that no other setting will give greater disturbance. Measurements are made on the mains terminals, all phases and neutral, on the terminals to the loads and on additional terminals of the appliance.

This test is not made when each individual regulating control consists of an entirely self-contained regulating circuit including all suppression components and operates independently of the others and does not control, either by design or fortuitously, any load that another individual regulator is controlling.

7.3 *Standard operating conditions and normal loads*

7.3.1 *Motor-operated appliances for household and similar purposes*

7.3.1.1 *Vacuum cleaners*

7.3.1.1.1 Vacuum cleaners without auxiliary apparatus, and not falling under 7.3.1.1.2 or 7.3.1.1.3 shall be measured while operating continuously without accessories and with an empty dust bag in place. Vacuum cleaners with a mains lead, retracted by an automatic cord reel are to be measured with the mains lead pulled out completely, 5.2.1.1 to be observed.

7.3.1.1.2 Vacuum cleaners with control leads for power control of the vacuum cleaner integrated in the suction hose shall be operated in accordance with 7.3.1.1.1.

For the frequency range 30 MHz to 300 MHz the measurement of disturbance power shall be performed with the absorbing clamp (in addition to the measurement at the mains terminals) by replacing the suction hose and its integrated lead with a flexible cord connected to the terminals on the main unit and of necessary length having the same number of wires as provided in the originally submitted suction hose; 6.3 shall be taken into account, the lead is supposed to be permanently connected.

If the length of the hose is more than 2 m, additional measurement of disturbance voltage (for the frequency range 148,5 kHz to 30 MHz) shall be performed (in addition to the measurement at the mains terminals) on each lead in the hose using the voltage probe as described in 5.1.3. The limits given in table 1, columns 4 and 5 apply.

7.3.1.1.3 Vacuum cleaners with control leads and power supply leads for a power nozzle integrated in the suction hose, the conditions are as in 7.3.1.1.1 and 7.3.1.1.2 but without the power nozzle connected. The limits given in table 1, columns 4 and 5 apply to both the control and power lead terminals.

7.3.1.1.4 Auxiliary power nozzles of vacuum cleaners shall be operated continuously without mechanical load on the brushes. The cooling, if necessary, shall be provided by a non-metallic hose.

If the power nozzle is connected by a non-detachable supply lead having a total length shorter than 0,4 m or if connected directly by plug and socket to the vacuum cleaner they shall be measured together. In all other cases, the appliances shall be measured separately.

7.3.1.2 Floor polishers shall be operated continuously without any mechanical load on the polishing brushes.

7.3.1.3 Coffee grinders shall be operated continuously without load.

7.3.1.4 Food mixers (kitchen machines), liquid-mixers, blenders, liquidizers shall be operated continuously without load. For speed controls see 7.1.5.

7.3.1.5 Clocks shall be operated continuously.

7.3.1.6 Massage apparatus shall be operated continuously without load.

7.3.1.7 Fans, cooker extractor hoods shall be operated continuously with maximum air flow; the fans shall be operated with and without heating, if this facility is provided. For thermostatically controlled switches, see 7.3.4.14. For fans and extractor hoods with electronic regulating controls 7.1.5 applies in addition.

7.3.1.8 Hair-dryers shall be operated as in 7.3.1.7. For thermostatically controlled switches see 7.3.4.14.

7.3.1.9 Refrigerators and freezers shall be operated continuously with the door closed. The thermostat shall be adjusted to the middle of the adjustment range. The cabinet shall be empty and not heated. The measurement shall be made after the steady state has been reached.

The click rate *N* is determined from half the number of switching operations.

NOTE - Due to ice deposition on the cooling element, the number of switching operations in normal use is about half that compared with the refrigerator being empty.

7.3.1.10 Washing machines shall be operated with water but without textiles, the temperature of the incoming water shall be in accordance with the manufacturer's instruction for use. The thermostat, if any, must be adjusted to the maximum setting for the programme chosen or to 90 °C, whichever is lower. The most unfavourable control programme of an appliance shall be taken for the determination of click rate *N*.

NOTE - For machines where the drying function forms a part of the programme, see 7.3.1.12.

7.3.1.11 *Dish-washing machines* as in 7.3.1.10.

7.3.1.12 Tumble-dryers shall be operated with textile material in form of pre-washed, double-hemmed cotton sheets having dimensions of approximately 0,7 m x 0,7 m and a mass between 140 g/m^2 and 175 g/m^2 in dry condition.

Control devices are set to either the lowest or highest position. The position that gives the highest click rate *N* shall be taken.

Separate tumble dryers are operated with half the maximum dry weight of cotton textile material recommended in the manufacturer's instruction for use. The specified dry weight of material shall be saturated with an equal weight of water at (25 ± 5) °C.

Tumble dryers combined with washing machines where the washing, spinning and drying operations are performed sequentially in a single container, are operated with half the maximum dry weight of cotton textile material recommended for the tumble dryer sequence operation in the manufacturer's instruction for use, the water content at the start of the dryer operation being that obtained at the end of the spinning operation after the previous washing operation.

7.3.1.13 Centrifugal dryers shall be operated continuously without load.

7.3.1.14 Razors and hair clippers shall be operated continuously without load, according to 7.1.2.

7.3.1.15 *Sewing machines*

For testing continuous disturbance of the motor, the motor shall be operated continuously at its maximum speed with the sewing gear, but not sewing a material.

For testing switch disturbance or semiconductor control disturbances see 7.2.3.1 or 7.2.5.1.

7.3.1.16 *Electro-mechanical office machines*

7.3.1.16.1 Electric typewriters shall be operated continuously.

7.3.1.16.2 Paper shredders are under consideration.

7.3.1.16.3 Copying machines are under consideration.

7.3.1.17 *Projectors*

7.3.1.17.1 Cine projectors shall be operated continuously with a film, the lamp being switched on.

7.3.1.17.2 Slide projectors shall be operated continuously without slides, the lamp being switched on. To determine the click rate *N*, see 7.2.3.3.

7.3.1.18 Milking machines shall be operated continuously without vacuum.

7.3.1.19 Lawn mowers shall be operated continuously without load.

7.3.2 *Electric tools*

7.3.2.1 *General*

7.3.2.1.1 For motor-operated tools with two rotating directions, measurements shall be made for each direction after operating periods of 15 min for each direction, the highest of the two disturbance levels shall comply with the limit.

7.3.2.1.2 Electric power-operated tools which incorporate vibrating or swinging masses shall, where possible, be measured with these masses removed or disconnected. Such tools, which have an inadmissible increase of their revolutions per minute (rev/min) when operating without their vibrating or swinging masses, can be operated at lower voltages so that their nominal operating rev/min is reached.

7.3.2.1.3 For tools designed to operate via a transformer intended to be connected to the mains supply, the following measuring procedure shall be applied:

a) *Terminal voltage: 148,5 kHz to 30 MHz*

If the tool is sold together with a step-up transformer the disturbance shall be assessed by measurements made on the power supply side of the transformer. The power supply lead from the tool to the transformer shall have a length of 0,4 m or, if longer, folded to form a horizontal bundle with a length between 0,3 m and 0,4 m.

If the tool is intended to be used with a transformer, the disturbance shall be assessed by measurements made on the power supply side of the transformer recommended by the manufacturer for use with the tool.

Where a tool is not supplied with a "sample" transformer at the time of the test, it shall be operated at its rated voltage, and the disturbance shall be assessed by measurements made at the tool's power input connections.

b) *Disturbance power: 30 MHz to 300 MHz*

The disturbance shall be assessed by measurements made on the tool's power input connection whilst being supplied at its rated voltage. The tool shall, during measurement, be equipped with a power supply lead with a length suitable for measurements with the absorbing clamp as described in 6.2.4.

7.3.2.2 *Handheld (portable) motor-operated tools*, as:

Drills, impact drills

Screwdrivers and impact wrenches

Thread-cutting machines

Grinders, disc-type and other sanders and polishers

Saws, knives and shears

Planing machines and hammers

shall be operated continuously without load.

7.3.2.3 Transportable (semi-stationary) motor-operated tools shall be operated similar to the handheld (portable) tools contained in 7.3.2.2.

7.3.2.4 *Soldering equipment, soldering guns, soldering irons*

a) For equipment with neither a thermostatically or electronically controlled switch, nor a motor, nor a regulating control (i.e. equipment which does not generate disturbances) measurements need not be performed.

b) Equipment with thermostatically or electronically controlled switch shall be operated with the highest possible duty-cycle. If there is a control device for the temperature the click rate *N* shall be determined for a duty cycle of (50 ± 10) % of this control device;

c) For equipment repeatedly operated with a push button switch (e.g. soldering guns) where only disturbance from this mains switch can be observed, the manufacturer's instruction for use (on the rating label) are to be taken in account: duty factor and cycle-duration ascertain the highest possible number of switching operation per time unit.

7.3.2.5 Glue guns shall be operated continuously with a glue stick in working position; if clicks occur, the click rate *N* shall be assessed under steady-state conditions, without adequate heat transfer, e.g. the gun in stand-by position on the table.

7.3.2.6 Heat gun (blower for removal of paint, blower for plastic welding etc.) shall be operated as described in 7.3.1.7.

7.3.2.7 Power staplers shall be measured with the longest nails or cramps in accordance with the manufacturer's instruction for use, while working on soft wood (e.g. pinewood).

For all power staplers the click rate *N* shall be determined while operating at 6 strokes per minute (independent of product information or manufacturer's instruction for use).

The limits for portable tools smaller than 700 W are valid for power staplers, independent of their rated power consumption.

7.3.2.8 Spray guns shall be operated continuously with the container empty and without accessories.

7.3.2.9 Internal vibrators shall be operated continuously in the centre of a round steel-plate container filled with water, the volume of the water being 50 times the volume of the vibrator.

7.3.2.10 Arc welding equipment is under consideration.

7.3.3 *Motor-operated electromedical apparatus*

7.3.3.1 *Dental drills*

For testing continuous disturbance of the motor, the motor shall be operated continuously at its maximum speed with the drilling apparatus, but not drilling a material.

For testing switch disturbance or semiconductor control disturbance see 7.2.3.1 or 7.2 5.1.

7.3 3.2 Saws and knives shall be operated continuously without load

7.3.3.3 Electrocardiograms and similar recorders shall be operated continuously with a tape or paper.

7.3.3.4 Pumps shall be operated continuously with a liquid.

7.3.4 *Electrical heating appliances*

Before making measurements the appliances shall reach steady-state conditions. The click rate *N* shall be determined for a duty-cycle of (50 ± 10) % of the control device, unless otherwise specified If the duty-cycle of (50 ± 10) % cannot be reached, the highest possible duty-cycle shall be applied instead

7.3.4.1 Cooking ranges, i.e. appliances having one or more hotplates controlled by thermostats or by energy regulators, shall be operated under conditions of adequate heat discharge· an aluminium pan filled with water is heated on the appliance until the water boils. The click rate *N* is half of the number (or of the highest number for several boiling plates measured in succession) of switching operations per minute for a duty-cycle (50 ± 10) % of the control device(s)

7.3.4.2 Cooking pans, table-type roasters, deep-fat fryers shall be operated under conditions of adequate heat discharge. Unless a minimum oil level is specified the quantity of oil above the highest point of the heating surface shall be:

- about 30 mm for cooking pans,
- about 10 mm table-type roasters,
- about 10 mm for deep-fat fryers.

7.3.4.3 Feed boilers, water boilers, kettles, coffee makers, milk boilers, feeding-bottle heaters, glue pots, sterilizers, wash boilers, shall be operated under conditions of adequate heat discharge half-filled with water and without lid. Immersion heaters shall be operated fully submerged. The click rate *N* shall be determined with a medium setting (60 °C) of a variable control device having a range between 20 °C and 100 °C or with the fixed setting of a fixed control device.

7.3.4.4 Instantaneous water heaters shall be operated in usual position of use with the water flow set at half of the maximum flow rate. The click rate N shall be determined with the highest setting of any control device fitted.

7.3.4.5 Thermal and non-thermal storage water heaters shall be operated in usual position of use, filled with typical quantity of water; no water to be drawn off during test. The click rate N shall be determined with the highest setting of any control device fitted.

7.3.4.6 Steam generators for indirect heating of appliances e.g. used in hotels and open waterbaths, shall be operated under adequate heat transfer and using the typical quantity of water.

7.3.4.7 Warming plates, boiling tables, heating drawers, heating cabinets shall be operated without adequate heat transfer.

7.3.4.8 Cooking ovens, grills, waffle irons, waffle grills shall be operated without adequate heat transfer, the oven door being closed.

NOTE - The microwave function, if any, is covered by CISPR 11

7.3.4.9 Toasters: if the duration of each click is less than 10 ms and the click rate N not exceeding 5, according to 4.2.3.4 no click limit applies.

All other toasters are to be tested according to 7.3.4.9.1 or 7.3.4.9.2 using as normal load slices of white bread about 24 h old (dimensions approximately 10 cm x 9 cm x 1 cm) to produce golden-brown toast.

7.3.4.9.1 Simple toasters are toasters which:

- incorporate a manually operated switch for switching on the heating element at the start of the toasting cycle and which will switch off the heating element automatically at the end of a predetermined period, and
- incorporate *no* automatic control device to regulate the heating element during the toasting operation.

For simple toasters the click rate N shall be determined and the level of disturbance generated assessed as follows:

a) *Determination of click rate N:*

Using the normal load the manual control shall be set to give the required result. With the appliance in a warm condition the average "on" time (t_1 seconds) of the heating element shall be determined from three toasting operations. A rest period of 30 s shall be allowed after each "on" time. The time for a complete toasting cycle is $(t_1 + 30)$ s. Thus the click rate N is:

$$N = 120/(t_1 + 30)\ \text{s}$$

b) *Assessment of disturbance level:*

The click rate *N*, established as described above shall be used to calculate the click limit L_q using the formula given in 4.2.2.2.

The toaster shall be tested applying the calculated click limit L_q and assessed using the upper quartile method given in 7.4.2.6. The toaster shall be operated for 20 cycles without load at the setting specified in item a). Each cycle shall comprise an operating period and a rest period, the latter having sufficient duration to ensure that the appliance is cooled to approximately room temperature at the beginning of the next cycle. Forced air cooling may be used.

7.3.4.9.2 Other toasters shall be operated under conditions of adequate heat discharge using the normal load. Each cycle shall consist of an operating period and a rest period, the latter having a duration of 30 s. The click rate *N* shall be determined at a setting at which the bread becomes golden-brown.

7.3.4.10 Ironing machines (ironing machines for table use, rotating ironing machines, ironing presses): the click rate *N*1 of the control device shall be determined *without* adequate heat transfer, the heating surface being in the open position and the control devices at high temperature setting.

The click rate *N*2 of the motor switch shall be determined under conditions of adequate heat discharge of the heating elements when two damp hand-towels (approximately 1 m × 0,5 m) are ironed per minute.

For fixing the click limit L_q the sum of the two click rates $N = N1 + N2$ has to be applied and the ironing machine shall be tested applying this limit and assessed using the upper quartile method given in 7.4.2.6 on both the control device and the motor switch.

7.3.4.11 Irons shall be operated under conditions of adequate heat discharge, using air, water or oil cooling. The click rate *N* is defined as the product of the factor 0,66 and the number of switching operations per minute for a duty-cycle of (50 ± 10) % of the control device operated at a high temperature setting.

7.3.4.12 Vacuum packager shall be operated with empty bags once per minute or according to the manufacturer's instruction for use.

7.3.4.13 Flexible electrical heating appliances (warming pads, electric blankets, bedwarmers, heating mattresses) shall be spread between two flexible covers (e.g. non-conducting mats), extending beyond the heating surface by at least 0,1 mm. The thickness and the heat conductivity shall be selected in such a way that the click rate *N* can be determined for a duty-cycle of (50 ± 10) % of the control device.

7.3.4.14 Room heaters (fan heaters, convectors, fluid-filled heaters as well as oil and gas burners and similar) shall be operated under adequate heat transfer.

The click rate *N* shall be determined for a duty-cycle of (50 ± 10) % of the control device or the maximum operating rate stated by the manufacturer.

The amplitude and duration of the disturbance shall be measured for the lowest position of the power range switch, if any.

For appliances having their thermostats and acceleration resistor connected to the mains, the same measurements shall be performed in addition with the switch in zero position.

When, in practice, the thermostat may be used together with inductive loads (e.g. relay, contactor) all measurements shall be performed using such a device, having the highest coil inductance used in practice.

In order to obtain a satisfactory measurement, it is essential that the contacts shall be operated for a sufficient number of times with a suitable load to ensure that the levels of disturbance are representative of those encountered in normal operation.

NOTE - See also 4 2.3 1 for room heating equipment intended to be used stationary

7.3.5 *Automatic goods-dispensing machines, entertainment machines and similar appliances*

As far as continuous disturbance occurs no special operating conditions are to be observed; the appliance is to be operated according to the manufacturer's instruction for use

If the machine is capable of producing more than two clicks within any 2 s period then all disturbance shall meet the continuous disturbance limits.

In case of automatic machines, where individual switching processes are (directly or indirectly) manually operated, and whereby no more than two clicks per sales, dispensing or similar processes are produced, 4.2.3.3 is applicable.

7.3.5.1 *Automatic dispensing machines*

Three dispensing operations are to be carried out, each subsequent operation being initiated once the machine has returned to a quiescent rest state. If the number of clicks produced by each of the dispensing operations is the same then the click rate *N* is numerically equal to one-sixth of the number of clicks produced in a single dispensing operation. If the number of clicks varies from operation to operation, a further seven dispensing operations are to be carried out and the click rate *N* shall be determined from at least 40 clicks on the assumption that the rest period between each dispensing operation was such that the 10 operations were uniformly distributed over a period of one hour. The rest period is to be included in the minimum observation time.

7.3.5.2 *Juke boxes*

An operating cycle is carried out by inserting the largest number of coins with the minimum value necessary to start the machine, followed by the selection and playing of the corresponding number of pieces of music. This operating cycle is to be repeated as often as necessary to produce a minimum of 40 clicks. The click rate *N* is determined as being half the number of clicks per minute.

NOTE - Due to the normal frequency of use and combination of coins, the number of clicks is taken as half that during the test observed

7.3.5.3 *Automatic entertaining machines incorporating a winnings-payout mechanism*

Electromechanical devices incorporated in the machine for storing and paying out winnings are to be disconnected where possible from the operating system to allow the entertainment function to be operated independently.

The entertainment cycle is initiated by inserting the largest number of coins with the minimum value necessary to start the machine. The entertainment cycle is to be repeated as often as necessary to produce a minimum of 40 clicks. The click rate *N1* is determined as being half the number of clicks per minute

NOTE - Due to the normal frequency of use and combination of coins, the number of clicks is taken as half that during the test observed

The average frequency and value of the winnings-payout is to be supplied by the *manufacturer. The click rate, N2, of the devices for storing and paying-out winnings are* assessed by simulation of a win of the average value supplied by the manufacturer rounded off to nearest payout value. The simulation of this win is to be repeated as often as necessary to produce a minimum of 40 clicks. The winnings-payout mechanism click rate, *N2*, is thus determined.

To allow for the frequency of paying-out, the number of entertainment cycles used to determine *N1* is multiplied by the average frequency of paying-out. This number of paying-outs per entertainment cycle is multiplied by *N2* to produce an effective winnings paying-out mechanism click rate, *N3*.

The click rate for the machine is the sum of the two click rates, i.e. *N1* + *N3*.

7.3.5.4 *Automatic entertainment machines with no winnings-payout mechanism*

7.3.5.4.1 *Pinball machines*

The machine shall be operated by a reasonable player (one with at least 30 min experience of operating this or similar machines). The largest number of coins with the minimum value necessary to start the machine are used. The operating cycle is to be repeated as often as necessary to produce a minimum of 40 clicks.

7.3.5.4.2 *Video machines and all other similar appliances*

These machines and appliances shall be operated in accordance with the manufacturer's instruction for use. The operating cycle shall be the programme obtained after inserting the largest number of coins with the minimum value necessary to start the machine. In the case of machines with several programmes, the programme giving the maximum click rate shall be selected. Should the duration of the programme be less than 1 min, the following programme is not to be started within one minute off the start of the previous programme so as to reflect normal use. This rest period is to be included in the minimum observation time. The programme shall be repeated as often as necessary to produce a minimum of 40 clicks.

NOTE - This subclause will be deleted when provisions for video machines and similar appliances are taken into account in CISPR 13

7.3.6 *Electric toys running on tracks*

7.3.6.1 *Electric toy systems*

7.3.6.1.1 An electric toy system includes both the moving component, the control device and the track, sold as a package.

7.3.6.1.2 The system shall be assembled to the instructions given in the sales package. The layout of the track shall be such as to maximize the area. Other components shall be arranged as indicated in figure 7.

7.3.6.1.3 Each moving component shall be tested separately while running on the track, all components in the sales package shall be tested, and the system shall also be tested with all moving components being operated simultaneously.

7.3.6.1.4 If a number of electric toy systems are made up of identical moving components, control devices and track and differ only in the numbers of components then only the electric toy system, which in one sales package contains the greatest number of moving components, shall be tested. The track shall cover the greatest area. If this electric toy system meets the requirements of 7.3.6.3, the other electric toy systems shall be deemed to meet the requirements without further testing.

7.3.6.1.5 The testing shall be carried out as described in 7.3.6.3.

7.3.6.2 *Individual components*

7.3.6.2.1 Individual components of a toy system which have been approved as part of a system, even when sold separately, shall require no further testing.

7.3.6.2.2 *Individual moving components, for example locomotives and cars*

Individual moving components, not approved already as part of a system, shall be tested on an oval track measuring 2 m x 1 m. The necessary track, leads and control device are to be supplied by the manufacturer of the individual moving component. If such auxiliary equipment is not supplied, tests shall be carried out on such auxiliary equipment as is convenient for the testing organization to use.

The track, leads and control devices are to be arranged as shown in figure 7. The tests are to be carried out as described in 7.3.6.3 The test report shall contain a description of the auxiliary equipment used

7.3.6.2.3 Controllers are under consideration

7.3.6.3 *Method of measurement*

7.3.6.3.1 *Terminal voltages 148,5 kHz to 30 MHz· earthed and non-earthed equipment*

The electric toy system shall be arranged in accordance with 7.3.6.1 or 7.3.6.2, whichever applies. The electric toy system shall be tested at a height of 0,4 m above a metal earth plate or above the metal floor of a screened room. The metal plate will extend at least 0,4 m beyond the edge of the electric toy system.

The power supply lead from the transformer to the track shall be of 0,4 m length or, if longer, folded back and forth parallel to the lead to form a horizontal bundle with a length of between 0,3 m and 0,4 m. Measurements shall be made on the power side of the transformer/controler device using the artificial mains V-network (see 5.1.2). The limits set out in table 1 columns 2 and 3 shall apply.

Measurements shall also be made at the terminals for the low voltage supply and control-leads on the track side of the transformer/controller, using a voltage probe as described in 5.1.3 in series with the input of the measuring receiver. For the principal measuring arrangement see figure 5. The limits specified in table 1, columns 4 and 5 apply.

7.3.6.3.2 *Disturbance power 30 MHz to 300 MHz*

The electric toy system shall be arranged in accordance with 7.3.6.1 and 7.3.6.2 whichever applies, except that the maximized track area shall not exceed 2 m x 1 m (see figure 7). The disturbance power measurements shall be made only on the track side of the transformer/controller using the absorbing clamp, the low voltage supply lead being extended as far as is needed. Any suppression devices fitted at the interconnection of the low voltage supply and the track shall be removed in order to allow a valid assessment of the disturbance radiated from the track itself.

All self-propelled vehicles contained in the electric toy system shall be running simultaneously but all other vehicles shall not be on the track. The limits set out in table 2, columns 2 and 3 shall apply.

7.3.7 *Miscellaneous equipment and appliances*

NOTE - Disturbance power limits in the frequency range 30 MHz to 300 MHz are not applicable to the devices quoted in 7 3 7 1 to 7 3.7 3, causing discontinuous disturbance solely (see 4.2 1).

7.3.7.1 *Time switches not incorporated in equipment or appliances*

If it is possible in normal use to set the switch such that there are more than two switching operations in any 2 s period then the disturbance produced shall comply with the limits for continuous disturbance.

If more than two switching operations in any 2 s period cannot be obtained, then the switch is adjusted to maximize the value of n_2 (the number of switching operations – see 7.4.2.3). The load current shall be 0,1 of the maximum rated value, and unless otherwise specified by the manufacturer, the load shall consist of incandescent lamps.

When the conditions of the click duration not exceeding 10 ms and the click rate N not more than five are fulfilled, in accordance with 4.2.3.4 there is no limit on the amplitude of the clicks produced.

For switches employing a manually operated "on" and automatic "off" the average "on" time (t_1 seconds) shall be determined from three successive operations while the switch is adjusted to maximize the value of n_2. A rest period of 30 s shall be allowed. The time for a complete cycle is (t_1 + 30) s, thus the click rate $N = 120/t_1 + 30$.

7.3.7.2 *Electric fence supply units*

The fence wire shall be replaced by a series RC circuit (item 2 in figure 6) comprising a 10 nF capacitor (nominal voltage of 10 kV d.c.) and a 250 Ω resistor (the 50 Ω in parallel with 50 µH incorporated in the artificial mains V-network provides the balance of the required 300 Ω load resistance). A resistor of 1 MΩ (item 6 in figure 6) is placed in parallel to the series circuit, to replace the leakage resistance of the fence wire. The appliance shall be operated in the normal position with a maximum inclination of 15 degrees from the vertical position.

The controls accessible without tools shall be set to the position of maximum disturbance.

Electric fences designed to be operated with a.c. or d.c. shall be tested with both kinds of supply.

The earth terminal of the fence circuit shall be connected to the earth terminal of the artificial mains V-network. If the terminals of the fence circuit are not clearly marked, they shall be earthed in turn.

NOTE - In order to avoid damage to the r.f. input of the measuring receiver by the high energy pulses of the electric fence unit, it may be necessary to insert an attenuator before the r.f. input.

7.3.7.3 *Electronic gas igniters*

The disturbance caused by manually operated single spark on demand electronic gas igniters, which operate only when a switch included for the purpose of mains connection or disconnection operates, is to be disregarded according to 4.2.3.3 (for instance central heating boilers and gas fires are excluded, but not cooking equipment).

Other equipment incorporating electronic gas igniters shall be tested without gas being applied to the equipment as follows:

7.3.7.3.1 *Single spark on demand igniters for cooking equipment*

Determine whether disturbance is continuous or discontinuous as follows:

Produce 10 single sparks with not less than 2 s between sparks. If any click exceeds 200 ms, the continuous disturbance limits of tables 1 and 2 apply. When the conditions of the click duration not exceeding 10 ms is fulfilled, it is assumed that the click rate N is not more than five and in accordance with 4.2.3.4 there is no limit on the amplitude of the clicks produced.

If any click is greater than 10 ms and if all clicks are less than 200 ms, then the click limit L_q shall be calculated as in 4.2.2.2 using an empirical click rate $N = 2$. This click rate is an assumed practical value, which gives a click limit L_q 24 dB above the continuous disturbance limit L.

The igniter shall be tested for 40 sparks with a minimum of 2 s between each spark, applying the calculated click limit L_q and assessed by the upper quartile method (see 7.4.2.6).

7.3.7.3.2 *Repetitive igniters for cooking equipment*

Determine whether the disturbance is continuous or discontinuous as follows:

Operate the igniter to produce 10 sparks.
If either,

a) any disturbance exceeds 200 ms, or

b) any disturbance is not separated from a subsequent disturbance or click by at least 200 ms, or

c) more than two clicks occur within any 2 s period, the continuous disturbance limits of tables 1 and 2 apply.

If

a) all clicks are less than 10 ms and

b) not more than two clicks occur within any 2 s period, it is assumed that the click rate N is not more than five and in accordance with 4.2.3.4 there is no limit on the amplitude of the clicks produced.

If

a) any click is greater than 10 ms and

b) not more than two clicks occur within any 2 s period, then the click limit L_q shall be calculated as in 4.2.2.2 using an empirical click rate $N = 2$. This click rate is an assumed practical value, which gives a click limit L_q of 24 dB above the continuous disturbance limit L.

The igniter shall be tested for 40 sparks applying the calculated click limit L_q and assessed by the upper quartile method (see 7.4.2.6).

7.3.7.4 *Insect killers: A resistive load of 2 kΩ shall be placed across the discharge path*

NOTE - *Normally only continuous disturbance can be observed*

7.3.7.5 Radiating equipment for personal care as appliances incorporating gas-discharge lamps. e.g. for therapeutic purposes, like ultra-violet and ozone lamps, see CISPR 15.

7.3.7.6 Electrostatic air cleaners shall be operated under normal working conditions, surrounded by a sufficient volume of air.

7.3.7.7 *Battery chargers*

NOTE - Disturbance power limits in the frequency range 30 MHz to 300 MHz are not applicable to these devices (see 4.1.2 4).

Battery chargers not incorporated in another appliance or equipment shall be measured in a manner similar to 5.2.4 with the mains supply terminals connected to an artificial mains V-network.

The load terminals shall be connected to a variable resistive load designed to ensure that the maximum specified current and/or voltage of the device under test can be obtained. See also 4.1.1.2. In cases when the load terminals are not accessible while loading, no measurement at the load terminals need to be made.

When a fully charged battery is required for correct operation of the device, the battery shall be connected in parallel with the variable load.

Battery chargers which would not operate as intended when connected to a resistive load or a fully charged battery shall be tested after being connected to a battery which is partially charged.

The load shall be varied until the maximum and minimum values of the voltage or current to be controlled have been reached; the maximum level of disturbance at the input and at the load terminals shall be recorded.

NOTE - The terminals to be connected to the battery are considered as additional terminals; the limits of table 1, columns 4 and 6 apply.

7.3.7.8 *Rectifiers*

NOTE - Disturbance power limits in the frequency range 30 MHz to 300 MHz are not applicable to these devices (see 4.1 2 4)

Rectifiers not incorporated in another appliance or equipment shall be measured in a manner similar to 5.2.4 with the mains supply terminals connected to an artificial mains V-network and the load terminals to a variable resistive load designed to ensure that the maximum specified current and/or voltage of the device under test can be attained.

The load shall be varied until the maximum and minimum values of the voltage or current to be controlled have been reached; the maximum level of disturbance at the input and at the load terminals shall be recorded.

7.3.7.9 *Convertors*

NOTE - Disturbance power limits in the frequency range 30 MHz to 300 MHz are not applicable to these devices (see 4 1.2.4)

Convertors not incorporated in appliances or equipment that can be connected to the mains supply shall be measured in a manner similar to 5.2.4 with the mains supply terminals connected to an artificial mains V-network and the load terminals to a variable load. Unless specified otherwise by the manufacturer, a resistive load shall be applied.

The load shall be varied until the maximum and minimum values of the voltage or current to be controlled have been reached; the maximum level of disturbance at the input and at the load terminals shall be recorded.

In the case of battery-operated convertors, the supply terminals have to be connected directly to the battery and the disturbance voltage at the battery side is measured as specified in 7.2.2 by means of the voltage probe as described in 5.1.3, limits given in 4.1.1.4, last paragraph.

7.3.7.10 *Lifting devices (electric hoists)*

To be operated in intermittent action without load.

The click rate *N* shall be determined with 18 working cycles per hour; each cycle shall comprise:

a) on hoists having only operating speed: lift; pause; lower; pause;

b) on hoists having two operating speeds with both the following cycles, alternating:

Cycle 1: fine lift (creep speed); lift (full speed); fine lift; pause; fine lower; lower (full speed); fine lower; pause;

Cycle 2: fine lift; pause; fine lower; pause.

NOTE - For shortening the time to be used for testing the cycles may be accelerated, but the click rate is calculated on the basis of 18 cycles per hour; care should be taken not to damage the motor by exceeding duty cycle.

For any traction drive a similar test shall be made.

Lifting and traction shall be measured and evaluated separately.

7.4 *Interpretation of results*

7.4.1 *Continuous disturbance*

7.4.1.1 The reading on the measuring receiver is observed for about 15 s for each measurement; the highest readings shall be recorded with the exception of any isolated spike which shall be ignored.

7.4.1.2 If the general level of the disturbance is not steady, but shows a continuing rise or fall of more than 2 dB in the 15 s period, then the disturbance measurement shall be performed in accordance with the conditions of normal use of the appliances, as follows:

a) If the appliance is one which may be switched on or off frequently, for instance an electric drill or a sewing-machine motor, then at each frequency of measurement the appliance shall be switched on just before each measurement, and switched off just after each measurement; the maximum level obtained during the first minute at each frequency of measurement shall be recorded;

b) if the appliance is one which in use normally runs for longer periods, for instance a hair-dryer, then it shall remain switched on for the period of the complete measurement, and at each frequency the level of disturbance shall be recorded only after a steady reading (subject to the provision of 7.4.1.1) has been obtained.

7.4.1.3 The disturbance voltage limits apply throughout the frequency range 148,5 kHz to 30 MHz and therefore the disturbance characteristics shall be assessed throughout this frequency range.

An initial survey or scanning of the complete range shall be made. In the case of quasi-peak detector measurement, the registered values shall be given at least at the following frequencies and at all frequencies at which there is a maximum:

160 kHz, 240 kHz, 550 kHz, 1 MHz, 1,4 MHz, 2 MHz, 3,5 MHz, 6 MHz, 10 MHz, 22 MHz, 30 MHz.

These frequencies are to be subject to a tolerance of ±10 %.

7.4.1.4 The disturbance power limits apply throughout the frequency range 30 MHz to 300 MHz and therefore the disturbance characteristics shall be assessed throughout this frequency range.

An initial survey or scanning of the complete range shall be made. In the case of quasi-peak detector measurement, the registered values shall be given at least at the following frequencies and at all frequencies at which there is a maximum:

30 MHz, 45 MHz, 65 MHz, 90 MHz, 150 MHz, 180 MHz, 220 MHz, 300 MHz.

These frequencies are to be subject to a tolerance of ± 5 MHz.

7.4.1.5 If in the frequency range 30 MHz to 300 MHz measurements are made on a single appliance, the measurements are to be repeated on at least one frequency in the vicinity of each of the following frequencies:

45 MHz, 90 MHz, 220 MHz.

If the observed differences between the levels for the respective frequencies during the first and second measurement are 2 dB or less, the first results are retained. If these differences are greater than 2 dB, the measurements of the complete spectrum shall be repeated and the highest level of all measurements at each frequency shall be taken.

NOTE - Further restriction to the relevant critical frequency is permitted for tests on running production

7.4.1.6 In the case of average detector measurement on disturbances caused by electronic devices, such as microprocessors, isolated spectral lines may occur, constituted by the fundamental frequency and higher harmonics of the disturbance source.

The values registered with the average detector shall be given at least at all isolated spectral lines.

7.4.1.7 When an equipment contains only a commutator motor as source of disturbance, average detector measurement need not be carried out.

7.4.2 *Discontinuous disturbance*

7.4.2.1 The minimum observation time *T* is obtained at both measuring frequencies (see 7.4.2.2) in the following way:

For appliances which do not stop automatically, the shorter time of either:

1) the time to register 40 clicks, or, where relevant, 40 switching operations, or

2) 120 min.

For appliances which stop automatically, the duration of the minimum number of complete programmes necessary to produce 40 clicks or, where relevant, 40 switching operations. When, 120 min after the beginning of the test, 40 clicks have not been produced, the test is stopped at the end of the programme in progress.

The interval between the end of one programme and the start of the next programme shall be excluded from the minimum observation time, except for those appliances for which an immediate re-start is inhibited. For these appliances, the minimum time required to re-start the programme shall be included in the minimum observation time.

7.4.2.2 The click rate *N* shall be determined under the operating conditions specified in 7.2 and 7.3 or, when not specified, under the most onerous conditions of typical use (maximum click rate) at 150 kHz for the frequency range 148,5 kHz to 500 kHz and at 500 kHz for the frequency range 500 kHz to 30 MHz.

The receiver attenuator is to be set such that an input signal equal in amplitude to the relevant limit L for continuous disturbance produces a mid-scale deflection on the meter.

NOTE - See clause 5 of CISPR 16, Part 2 (Draft 1989) for more details.

7.4.2.3 The click rate *N* is obtained in the following way:

In general *N* is the number of clicks per minute determined from the formula $N = n_1/T$, n_1 is the number of clicks during the observation time *T* minutes.

For certain appliances (see 4.2.3.7) the click rate *N* is determined from the formula $N = n_2 \times f/T$ where n_2 is the number of switching operations (see 3.3) during the observation time *T* and *f* is a factor given in annex A, table A.2.

7.4.2.4 The relevant click limit L_q for discontinuous disturbance is determined in accordance with the formula given in 4.2.2.2.

7.4.2.5 The measurement of disturbance generated by switching operations shall be performed with the same programme as has been chosen when determining the click rate *N* at the following restricted number of frequencies:

150 kHz, 500 kHz, 1,4 MHz and 30 MHz.

7.4.2.6 The appliance is assessed for compliance with the higher limit L_q in accordance with the upper quartile method, *the appliance being tested for a time not less than the minimum observation time T.*

If the click rate *N* is determined from the number of clicks, the appliance under test shall be deemed to comply with the limit if not more than a quarter of the number of clicks registered during the observation time *T* exceeds the click limit L_q.

If the click rate *N* is determined from the number of switching operations, the appliance under test shall be deemed to comply with the limit if not more than a quarter of the number of switching operations registered during the observation time *T* produce clicks exceeding the click limit L_q.

NOTES

1 An example of the use of the upper quartile method is given in annex B.

2 See annex C for guidance on the measurement of discontinuous disturbance.

8 *Interpretation of CISPR radio disturbance limit*

8.1 *Significance of a CISPR limit*

8.1.1 A CISPR limit is a limit which is recommended to national authorities for incorporation in national standards, relevant legal regulations and official specifications. It is also recommended that international organizations use these limits.

8.1.2 The significance of the limits for type approved appliances shall be that on a statistical basis at least 80 % of the mass-produced appliances comply with the limits with at least 80 % confidence.

In the case of discontinuous disturbance when the shortened procedure described in *8.2.2.3 is applied, compliance with the limits on the 80 % – 80 % basis is not guaranteed.*

8.2 *Type tests*

Type tests shall be made:

8.2.1 For appliances producing continuous disturbance:

8.2.1.1 Either on a sample of appliances of the type using the statistical method of evaluation in accordance with 8.3.

8.2.1.2 Or, for simplicity's sake, on one appliance only (see 8.2.1.3).

8.2.1.3 Subsequent tests are necessary from time to time on appliances taken at random from the production, especially in the case indicated in 8.2.1.2.

8.2.2 For appliances producing discontinuous disturbance:

8.2.2.1 On one item only.

8.2.2.2 Subsequent tests are necessary from time to time on an appliance taken at random from the production.

8.2.2.3 In the case of controversy with regard to a type approval test, the following shortened procedure is applied:

If the first appliance is measured and fails, three additional appliances shall be measured at the same frequency or frequencies at which the first appliance failed.

The three additional appliances are judged according to the same requirements as applied to the first appliance.

If all three additional appliances comply with the relevant requirements, the type is approved.

If one or more additional appliances do not comply, the type is rejected.

8.3 *Compliance with limits for appliances in large-scale production*

Statistically assessed compliance with limits shall be made according to one of the two tests described below or to some other test which ensures compliance with the *requirements of 8 1.2 above.*

8.3.1 *Test based on the non-central t-distribution*

This test should be performed on a sample of not less than five items of the type, but if, in exceptional circumstances, five items are not available, then a sample of four or three shall be used. Compliance is judged from the following relationship:

$$\bar{x} + ks_n \leq L$$

where

$\bar{x}$ is the arithmetic mean of the measured value of n items in the sample

$$s_n = \Sigma(x_n - \bar{x})^2 / (n-1)$$

x_n is the value of the individual item

L is the appropriate limit

k is the factor derived from tables of the non-central t-distribution which ensures with 80 % confidence that 80 % of the type is below the limit, the value of k depends on the sample size n and is stated below

The quantities x_n, $\bar{x}$, s_n and L are expressed logarithmically (dB(µV), dB(µV/m) or dB(pW)).

n	3	4	5	6	7	8	9	10	11	12
k	2,04	1,69	1,52	1,42	1,35	1,30	1,27	1,24	1,21	1,20

8.3.2 *Test based on the binomial distribution*

This test should be performed on a sample of not less than seven items.

Compliance is judged from the condition that the number of appliances with an interference level above the appropriate limit may not exceed c in a sample of size n.

n	7	14	20	26	32
k	0	1	2	3	4

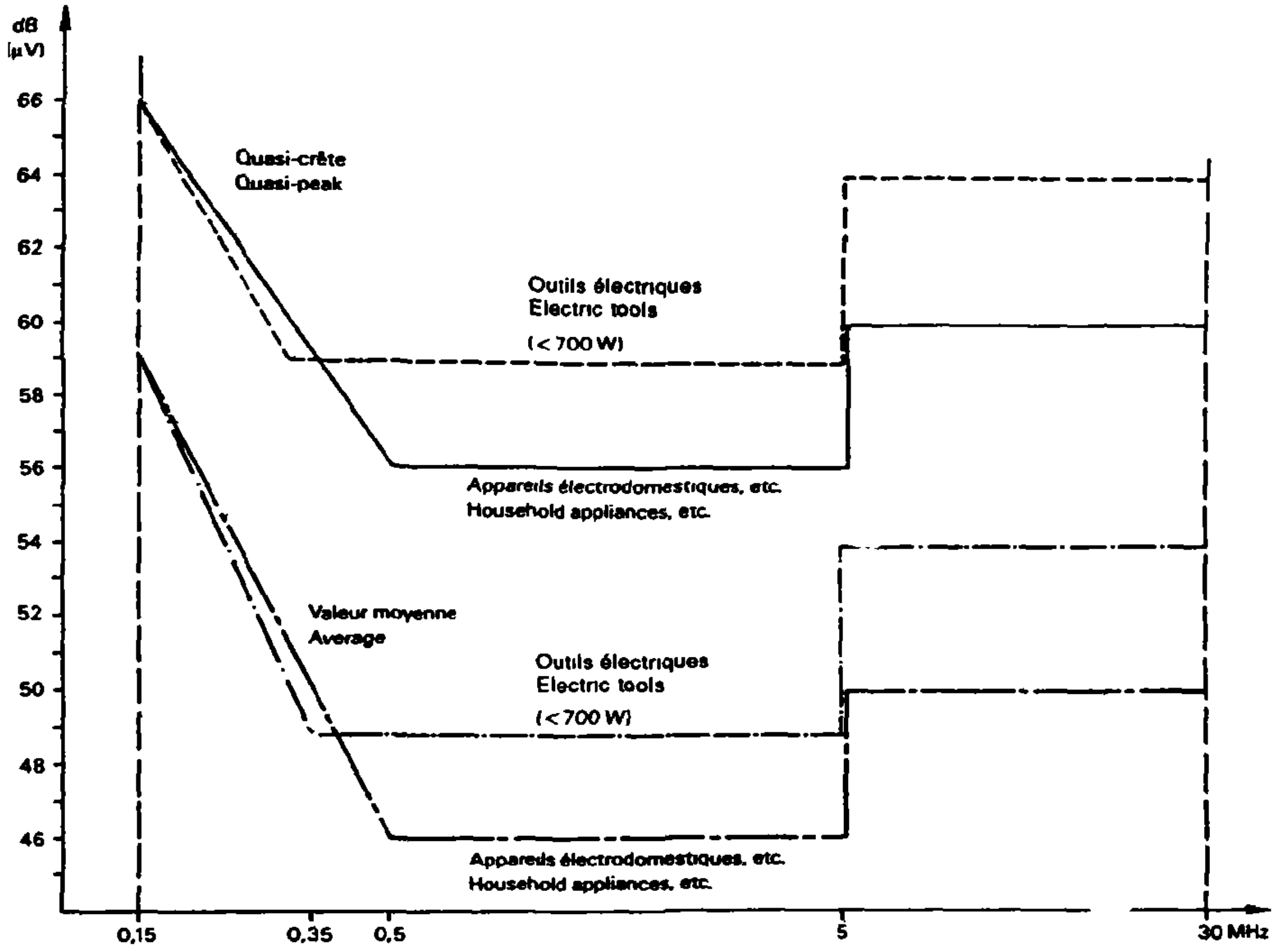
8.3.3 Should the test on the sample result in non-compliance with the requirements in 8.2.1 or 8.2.2, then a second sample may be tested and the results combined with those from the first sample and compliance checked for the larger sample.

NOTE - For general information see CISPR 16, Section nine: Statistical considerations in the determination of limits of radio interference

8.4 *The banning of sales*

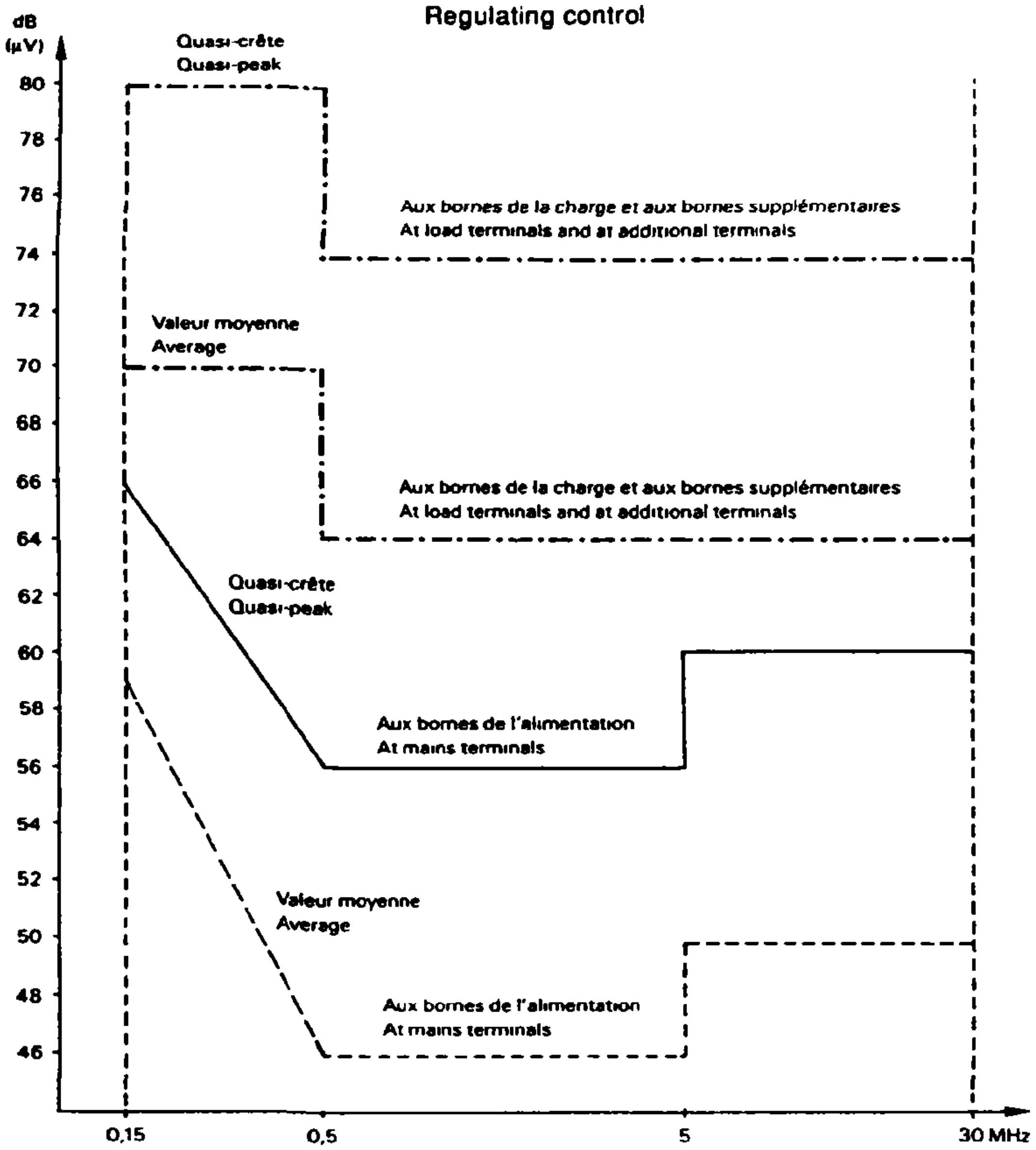
The banning of sales or withdrawal of a type approval, as result of a dispute shall be considered only after tests have been carried out using the statistical method of evaluation. Statistical assessment of compliance with requirements shall be made in accordance with 8.2.2.3 for discontinuous disturbance and in accordance with 8.3.1 for continuous disturbance.

Appareils électrodomestiques et outils électriques
Household appliances and electric tools



* For electric tools - 700 W à 1 000 W +4 dB
> 1 000 W : +10 dB

Figure 1 - Graphical representation of the limits (see 4.1.1)



Dispositifs de commande et de régulation
Regulating control

Figure 2 – Graphical representation of the limits (see 4.1.1)

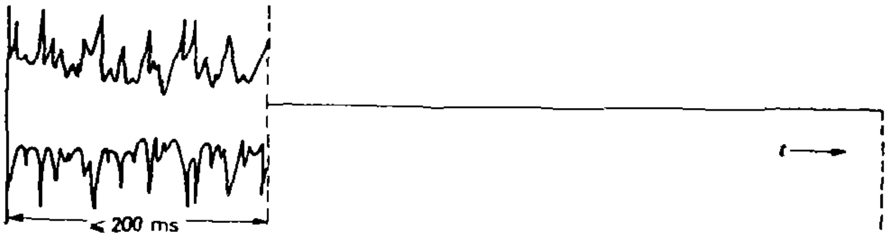


Figure 3a

One click

Disturbance not longer than 200 ms consisting of a continuous series of impulses and observed at the intermediate frequency output of the measuring receiver

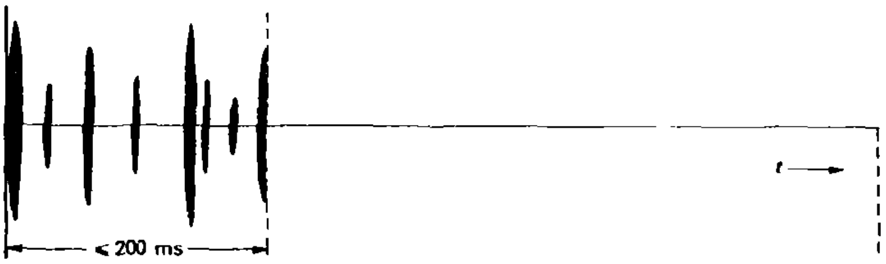


Figure 3b

One click

Individual impulses shorter than 200 ms, spaced closer than 200 ms not continuing for more than 200 ms and observed at the intermediate frequency output of the measuring receiver

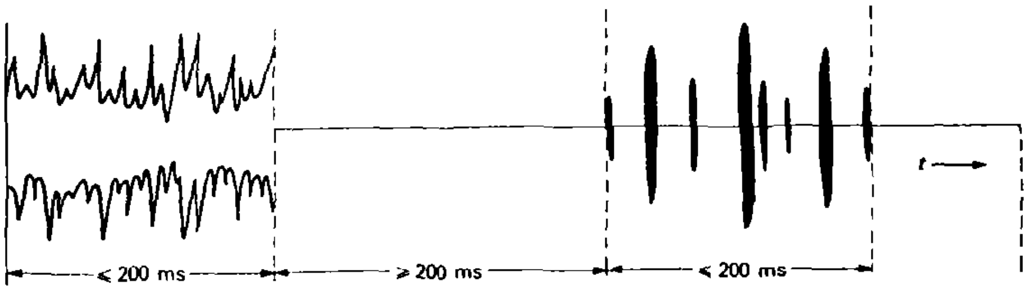


Figure 3c

Two clicks

Two disturbances neither exceeding 200 ms, spaced by a minimum of 200 ms and observed at the intermediate frequency output of the measuring receiver

Figure 3 – Examples of discontinuous disturbances classified as clicks (see 3.2)

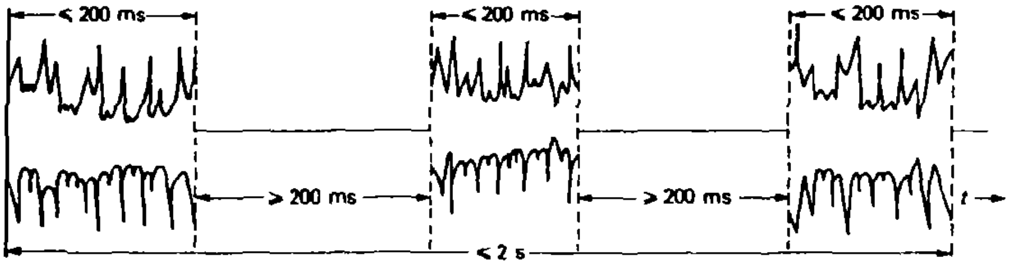


Figure 4a

More than two clicks in a period of 2 s and observed at the intermediate frequency output of the measuring receiver.

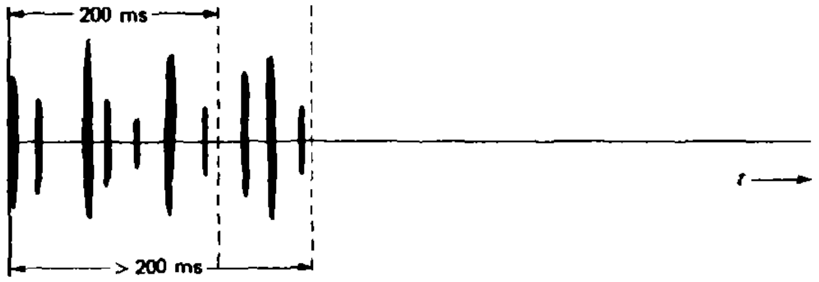


Figure 4b

Individual impulses shorter than 200 ms, spaced closer than 200 ms continuing for more than 200 ms and observed at the intermediate frequency output of the measuring receiver

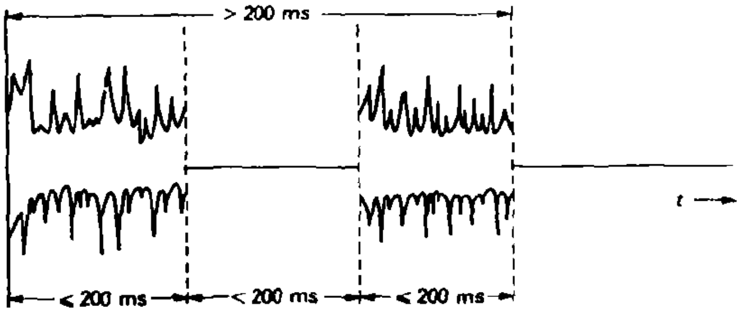
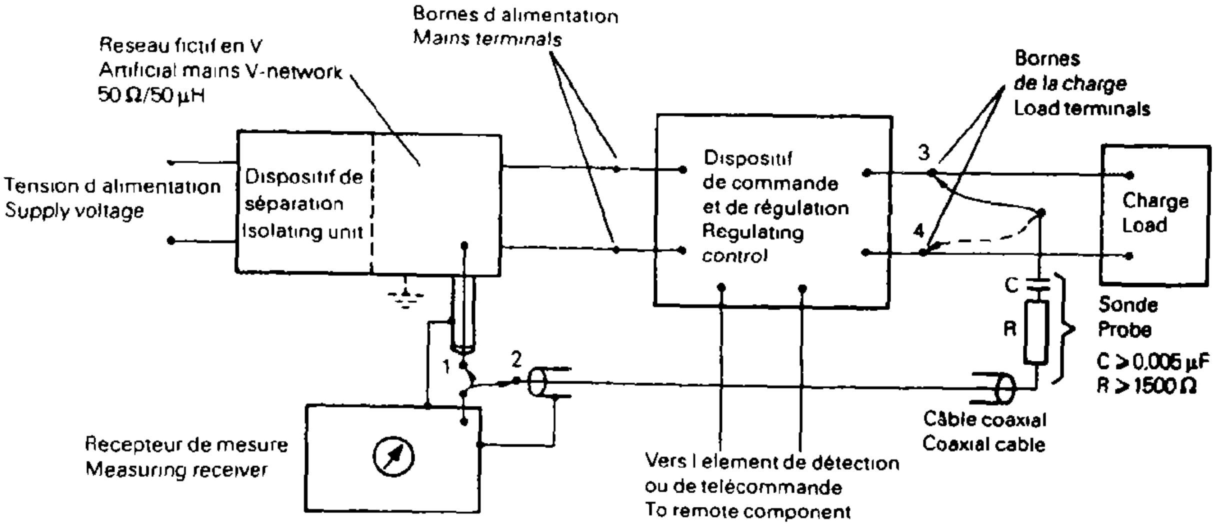


Figure 4c

Two disturbances spaced by less than 200 ms, and having a total duration of more than 200 ms and observed at the intermediate frequency output of the measuring receiver

Figure 4 – *Examples of discontinuous disturbance for which the limits of continuous disturbance apply* (see 4.2.2.1). For some exceptions from this rule see 4.2.3.2, 4.2.3.5 and 4.2.3.6.



1 Switch positions for mains measurements

2 Switch positions for load measurements

3 }
4 } Successive connections during load measurements

NOTES

1) The length of the coaxial cable of the probe shall not exceed 2 m.

2) When the switch is in position 2, the output of the artificial mains V-network at terminal 1 shall be terminated by an impedance equivalent to that of the CISPR measuring receiver.

3) Where a two-terminal regulation control is inserted in one lead only of the supply, measurements shall be made by connecting the second apply lead as indicated in figure 5a.

Figure 5 – Measuring arrangement for regulating controls (see 5.2.4)

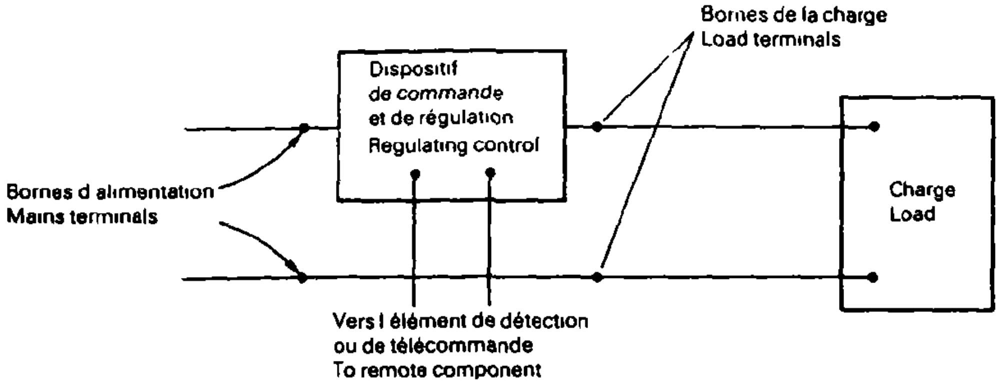
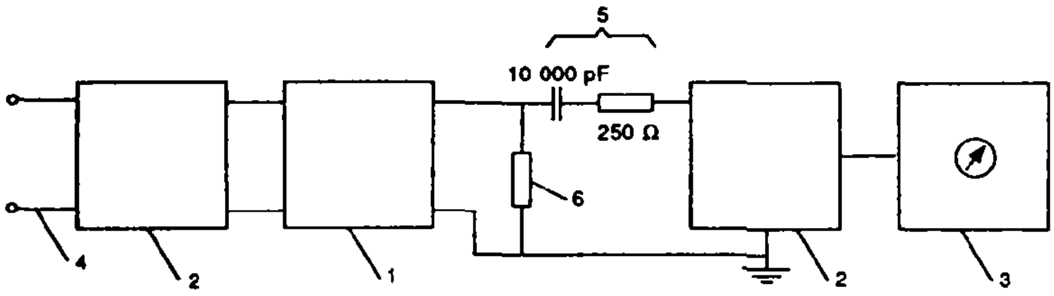
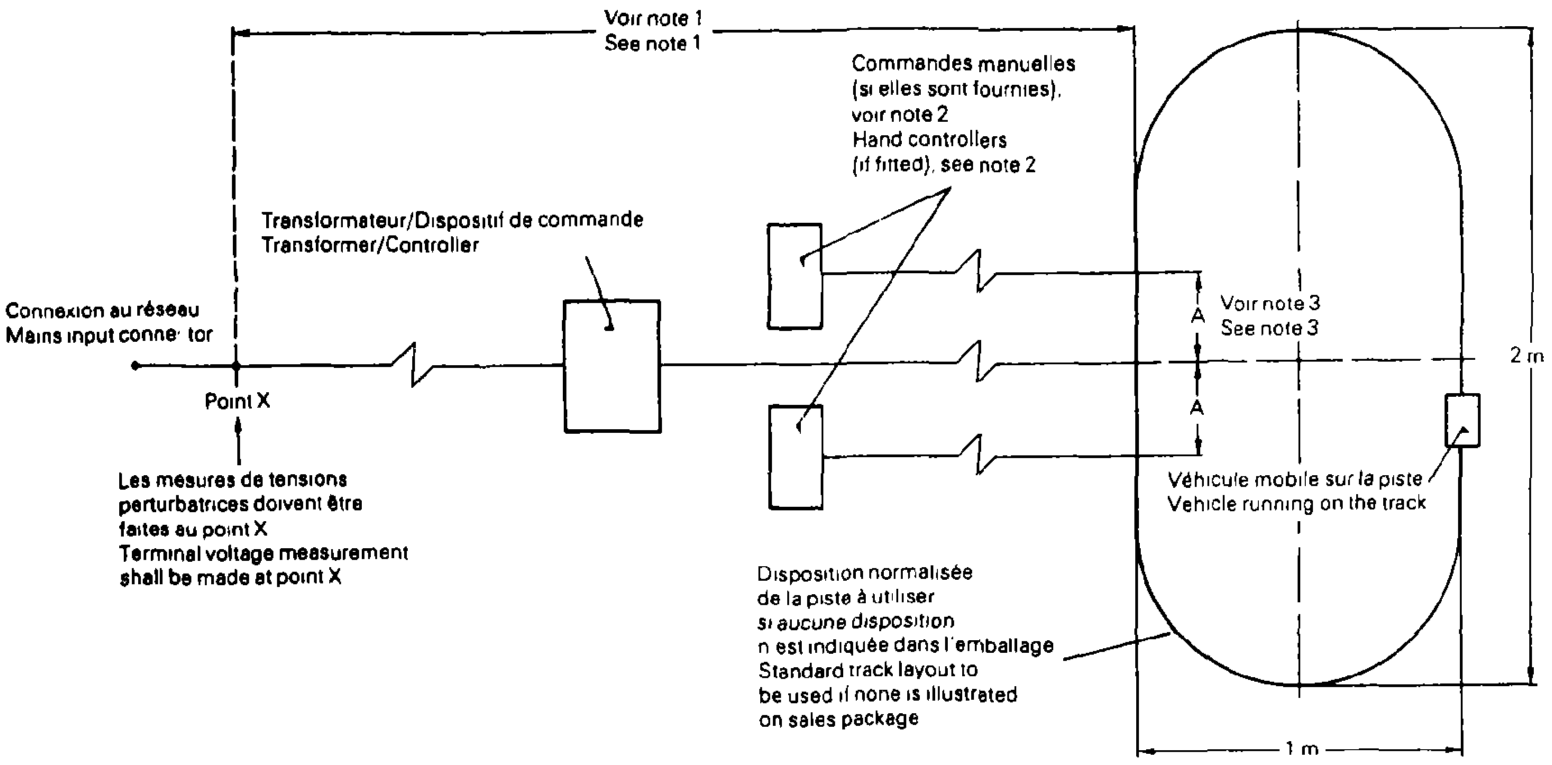


Figure 5a – Measurement arrangement for two-terminal regulating controls



1 Supply unit of electric fence
2 Artificial mains V-network (see 5 1.2)
3 CISPR receiver conforming to CISPR 16
4 Mains lead
5 Elements of the equivalent circuit to replace the fence (the specified load resistance of 300 Ω is provided by the 250 Ω resistor in series with the 50 Ω impedance of the artificial mains V-network)
6 Resistor of 1 MΩ (20 kV surge-voltage) to simulate leakage (to be added to the equivalent circuit of item 5)

Figure 6 – Arrangement for measurement of disturbance voltage produced by electric fence supply units (see 7.3.7.2)


Voir note 1
See note 1
Commandes manuelles
(si elles sont fournies),
voir note 2
Hand controllers
(if fitted), see note 2
Transformateur/Dispositif de commande
Transformer/Controller
Connexion au réseau
Mains input connector
Point X
Les mesures de tensions perturbatrices doivent être faites au point X
Terminal voltage measurement shall be made at point X
A
A
Voir note 3
See note 3
2 m
Véhicule mobile sur la piste
Vehicle running on the track
Disposition normalisée de la piste à utiliser si aucune disposition n est indiquée dans l'emballage
Standard track layout to be used if none is illustrated on sales package
1 m

NOTES

1 For terminal voltage measurements (0,15 MHz to 30 MHz) the nearest part of the track should not be further than 1 m from point X.

For power measurements (30 MHz to 300 MHz) the distance from the transformer/controller to the nearest part of the track must be extended (to 6 m) to accommodate the use of the absorbing clamp.

2 Distance A shall be adjusted to 0,1 m where possible.

Figure 7 – Measuring arrangement for toys running on tracks

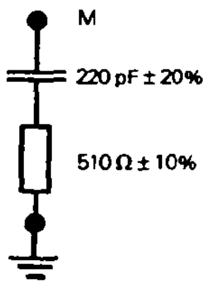
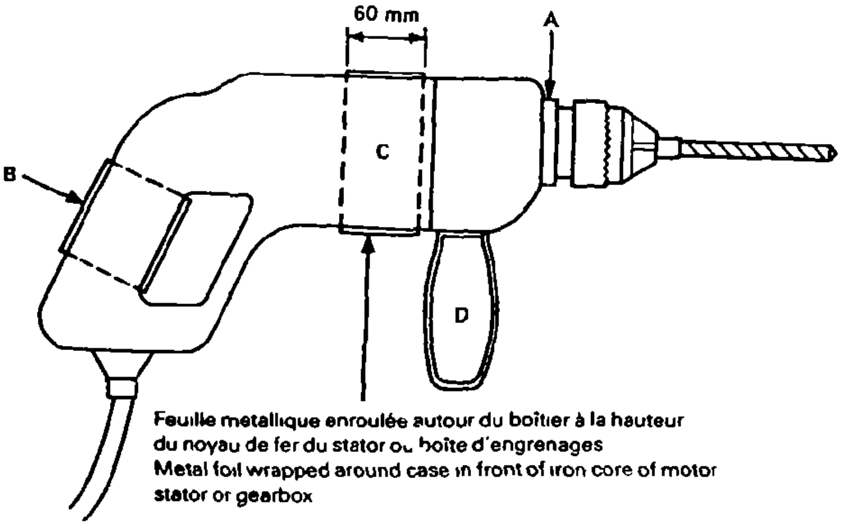
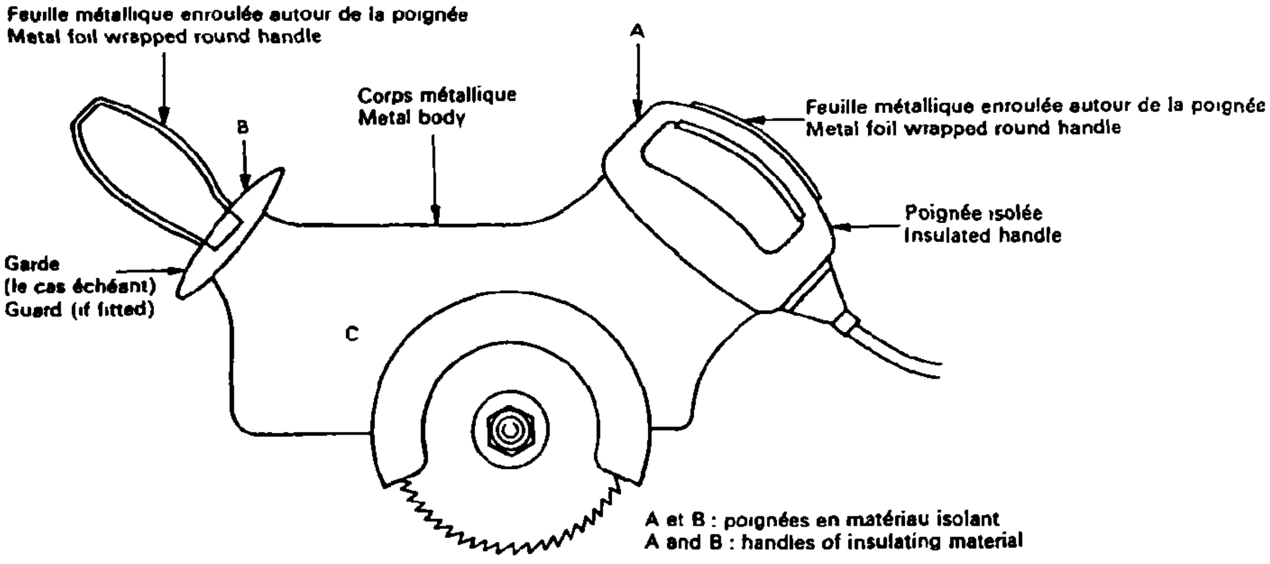


Figure 8a - RC element



Feuille metallique enroulée autour du boîtier à la hauteur du noyau de fer du stator ou boîte d'engrenages
Metal foil wrapped around case in front of iron core of motor stator or gearbox

Figure 8b – Portable electric drill


Feuille métallique enroulée autour de la poignée
Metal foil wrapped round handle
B
Corps métallique
Metal body
A
Feuille métallique enroulée autour de la poignée
Metal foil wrapped round handle
Poignée isolée
Insulated handle
Garde
(le cas échéant)
Guard (if fitted)
C

A et B : poignées en matériau isolant
A and B : handles of insulating material

Figure 8c - Portable electric saw

Figure 8 – Application of the artificial hand (5.1.4 and 5.2.2.2)

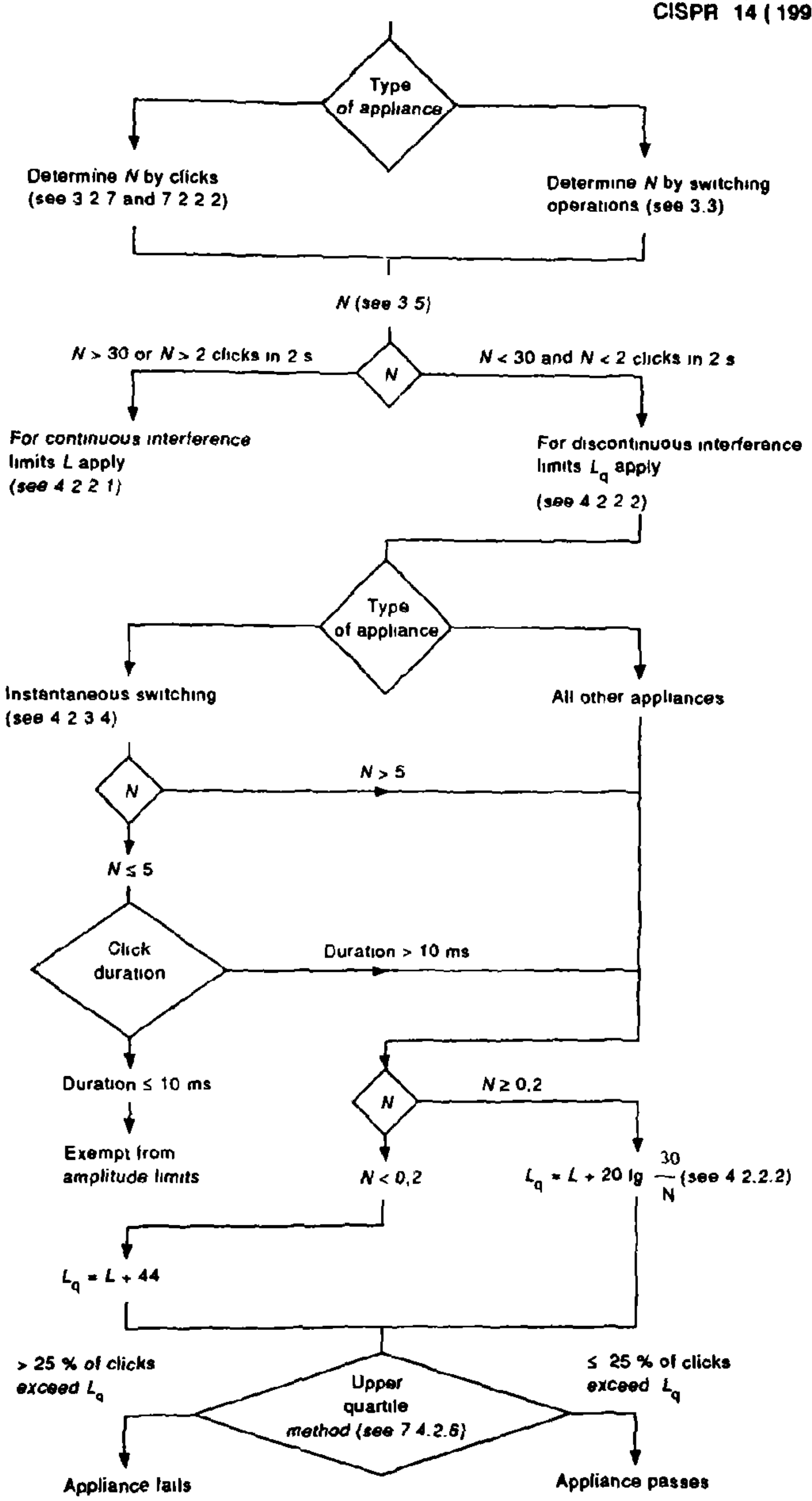

Type of appliance
Determine *N* by clicks (see 3 2 7 and 7 2 2 2)
Determine *N* by switching operations (see 3.3)
N (see 3 5)
N > 30 or *N* > 2 clicks in 2 s
N
N < 30 and *N* < 2 clicks in 2 s
For continuous interference limits *L* apply (see 4 2 2 1)
For discontinuous interference limits L_q apply (see 4 2 2 2)
Type of appliance
Instantaneous switching (see 4 2 3 4)
All other appliances
N
N > 5
N ≤ 5
Click duration
Duration > 10 ms
Duration ≤ 10 ms
Exempt from amplitude limits
N
N ≥ 0,2
N < 0,2
$L_q = L + 20 \lg \frac{30}{N}$ (see 4 2.2.2)
$L_q = L + 44$
> 25 % of clicks exceed L_q
Upper quartile method (see 7 4.2.6)
≤ 25 % of clicks exceed L_q
Appliance fails
Appliance passes

Figure 9 – Flow diagram for measurement of discontinuous disturbance (see annex C)

Annex A
(normative)

Limits of disturbance caused by the switching operations of specific appliances when the formula 20 lg 30/*N* is applicable

Table A 1 – Examples of appliances and application of limits according to 4 2 2 and 4.2 3 4 for which the click rate *N* is derived from the number of clicks.

Type of appliance	Operating conditions subclause	Type of appliance	Operating conditions subclause
Bed warmers	7 3 4 13	Ironing presses	7 3 4 10
Blankets	7 3 4 13	Kettles	7 3 4 3
Boilers	7 3 4 3	Milk boilers	7 3 4 3
Coffee percolators	7 3 4 3	Roasters, table type	7 3 4 2
Convectors*	7 3 4 14	Room heaters*	7 3 4 14
Cooking ovens	7 3 4 8	Steam generators	7 3 4 6
Cooking pans	7 3 4 2	Sterilizers	7 3 4 3
Deep-fat fryers	7 3 4 2	*Stewing pans*	7 3 4 2
Dish-washing machines	7 3 1 11	Storage water heaters, thermal and non-thermal	7 3 4 5
Electric fences	7 3 7 2		
Fan heaters*	7 3 4 14	Thermostats, separate for control of room or water heaters, oil and gas burners*	7 2 4
Feeding bottle heaters	7 3 4 3		
Fluid-filled heaters*	7 3 4 14		
Frying pans	7 3 4 2	Toasters	7 3 4 9
Glue pots	7 3 4 3	Waffle grills	7 3 4 8
Grills	7 3 4 8	Waffle irons	7 3 4 8
Hair-dryers	7 3 1 8	Warming pads	7 3 4 13
Heating mattresses	7 3 4 13	Warming plates	7 3 4 7
Immersion heaters	7 3 4 3	Washing machines	7 3 1 10
Ironing machines, rotating	7 3 4 10	Water heaters, instant*	7 3 4 4
Ironing machines, table and free standing	7 3 4 10		

In the frequency range 148,5 kHz to 30 MHz the limits as given in table 1, column 2 – for the measurement with the quasi-peak detector on household and similar equipment – apply enlarged with

$$20 \lg \frac{30}{N} \text{ dB } (\mu\text{V}) \text{ for } 0{,}2 \le N < 30$$

* For thermostats for, or integrated in, room heating equipment intended to be used stationary, see 4 2 3 1 and table A 2

Table A.2 – Examples of appliances and application of limits for which the click rate *N* is derived from the number of switching operations and the factor *f* as mentioned in the relevant operating conditions

Type of appliance	Operating conditions *sub-clause*	Factor *f*
Thermostats for room heating equipment*	7.2.4	1
Refrigerators, freezers	7.3.1.9	0,5
Cooking ranges with automatic plates	7.3.4.1	0,5
Appliances with one or more boiling plates controlled by thermostats or energy regulators	7.3.4.1	0,5
Irons	7.3.4.11	0,66
Sewing machine speed controls and starter switches	7.2.3.1	1
Dental drill speed control and starter switches	7.2.3.1	1
Electro-mechanical office machines	7.2.3.2	1
Slide projector picture change devices	7.2.3.3	1

In the frequency range 148,5 kHz to 30 MHz the limits as given in table 1, column 2 – for the measurement with the quasi-peak detector on household and similar equipment – apply enlarged with

$$20 \lg \frac{30}{N} \text{ dB}(\mu\text{V}) \text{ for } 0{,}2 \le N < 30$$

* See 4.2.3.1

Annex B
(informative)

Example of the use of the upper quartile method to determine compliance with disturbance limits (see 7.4.2.6)

Example: (Tumble-dryer)

The appliance has a programme which stops automatically; therefore the observation time is defined and contains more than 40 clicks.

Frequency: 500 kHz
Limit for continuous disturbance level: 56 dB (µV)

First test run

Disturbance No.:									
1	2	3	4	5	6	7	8	9	10
*	*	*	–	*	–	*	*	–	*
11	12	13	14	15	16	17	18	19	20
*	*	*	*	*	*	*	*	*	*
21	22	23	24	25	26	27	28	29	30
*	*	*	*	*	*	*	*	*	*
31	32	33	34	35	36	37	38	39	40
*	–	*	*	–	*	*	*	*	*
41	42	43	44	45	46	47	48	49	50
*	*	–	*	*	*	*	*	*	–
51	52	53	54	55	56				
–	*	*	*	–	*				

* is the click
– is the discontinuous disturbance (not exceeding the limit for continuous disturbance)

- total time of run (T) = 35 min
- total number of clicks (n_1) = 47

$$N = \frac{47}{35} = 1{,}3$$

$$20 \lg \frac{30}{N} = 20 \lg \frac{30}{1{,}3} = 27{,}5 \text{ dB}$$

Click limit L_q for 500 kHz = 56 + 27,5 = 83,5 dB (µV)
The number of clicks allowed above the click limit L_q:

$$\frac{47}{4} = 11{,}75,$$ which means that only 11 such clicks are allowed

A second test run is made to determine how many clicks exceed the click limit L_q. The time for this second run is the same as the time taken for the first run.

Frequency: 500 kHz
Click limit L_q: 83,5 dB (µV)

Second test run

Disturbance No.:	1	2	3	4	5	6	7	8	9	10
	•	–	•	–	–	•	•	–	–	•
	11	12	13	14	15	16	17	18	19	20
	–	–	–	–	–	–	–	•	•	•
	21	22	23	24	25	26	27	28	29	30
	–	•	–	•	–	–	–	–	–	–
	31	32	33	34	35	36	37	38	39	40
	–	–	–	–	–	•	–	•	–	–
	41	42	43	44	45	46	47	48	49	50
	•	•	–	–	–	–	–	–	–	–
	51	52	53	54	55	56				
	–	–	–	–	–	–				

• are the clicks above click limit L_q
– are the clicks not exceeding click limit L_q

- total time of run (*T*) = 35 min (identical to first run)
- number of clicks greater than click limit L_q = 14
- allowed number of clicks = 11, therefore *the appliance is not accepted.*

Annex C
(informative)

Guidance notes for the measurement of discontinuous disturbance

C.1 General

These guidance notes do not purport to interpret the provisions of this standard, but are intended to guide the user through the rather complex procedure, thereby facilitating the measurement of discontinuous disturbance.

Disturbance measurements are performed using the following measuring devices specified in CISPR 16, Part 1;

- the measuring receiver as in clause 2;
- the artificial mains V-network as in clause 11,
- a (storage) oscilloscope or the disturbance analyzer as in clause 14, and assessment of the measuring results in accordance with 5 3 of CISPR 16, Part 2

C.1.1 For the purpose of this measurement, appliances may be divided into two broad categories as follows.

A) those which generate discontinuous disturbance but do not generate continuous disturbance,

B) those which generate both types of disturbance

The two broad classifications may be further divided as follows:

a) appliances in which the assessment of discontinuous disturbance may be made without the use of a measuring receiver, for instance by the use of an oscilloscope connected to an artificial mains V-network (see C.2.3),

b) appliances for which the use of the CISPR measuring receiver with its weighted response is necessary;

c) appliances for which relaxation of the limits is specified under certain conditions (see 4.2.2.2 and 4.2.3).

The flow diagram shown in figure 9, gives a simplified guide to the measurement of discontinuous disturbance.

C.1.2 Discontinuous disturbance is subjectively less disturbing in the audio output of sound broadcast receivers and in the video and audio outputs of television receivers compared with continuous disturbance, because it generally occurs in bursts. Thus the subjective effect is dependent upon the spacing of these bursts which is related to the click rate *N* (see 3.5). Therefore, there are a number of relaxations on the limits related to discontinuous disturbance.

During the measurement the appliances shall be operated as prescribed in clause 7.

To determine the click rate N (see 3.5) by the method of clicks, set the receiver attenuators so that an input signal equal in amplitude to the limit for continuous disturbance produces a mid-scale deflection on the meter and count the number of disturbances (of duration less than 200 ms) which cause a greater deflection during the observation time (see 3.4).

For certain appliances (see 4.2.3.7), the click rate N is determined from the number of switching operations (see 3.3) of the contacts which are causing the disturbance.

The application of the formula 20 lg 30/N (where N is the click rate) allows a relaxation in the limit of 6 dB for each reduction of N in half the value (see 4.2.2.2). Further relaxations for specific appliances are detailed in 4 2.3.

The value of N determined is to be used in the formula 20 lg 30/N to calculate the (relaxed) click limit L_q (see 3.6). The receiver attenuators shall then be set for the click limit L_q in a manner similar to that already described, and the number of disturbances (duration less than 200 ms) which exceed the click limit L_q during the same observation time shall be counted.

The upper quartile method shall then be applied to the results to determine compliance (see annex B).

In general, the measurement of discontinuous disturbance requires the determination of its amplitude and duration characteristics as well as the spacing between various groups of discontinuous disturbances. Moreover, in order to determine whether equipment satisfies the appropriate disturbance limits it is necessary to classify the discontinuous disturbance in accordance with the following basic parameters:

a) amplitude of discontinuous disturbances – is it above the limit of continuous disturbance and, subsequently, is it above the click limit L_q?

b) duration of discontinuous disturbance – is it less than 10 ms, is it greater than 10 ms but less than 200 ms, it is greater than 200 ms?

c) spacing between discontinuous disturbances (for instance clicks) – is it less than 200 ms, is it greater than 200 ms, is it such that more than two disturbances occur in any 2 s period?

d) rate of discontinuous disturbances (click rate N) – what is the number of discontinuous disturbances per minute, is it greater than 30, are there more than two clicks in 2 s, is it less than 30 but greater than 5, is it less than 5 but greater than 0,2, is it less than 0,2?

The measurement of these basic parameters is described in clause C.2.

Special precautions have to be taken when discontinuous disturbance has to be measured in the presence of continuous disturbance as the latter may influence the discontinuous disturbance measurement to a certain extent. In such circumstances the i.f. reference level (see C.2.1) has to be increased by an appropriate amount. In practice this may be achieved in any convenient manner providing the required result is obtained, for instance connecting an attenuator at the i.f. output of the measuring receiver.

C.2 Measurement of the basic parameters

C.2.1 *Level setting of r.f. input attenuator*

For the measurement and evaluation of discontinuous disturbance the r.f. input attenuator of the measuring receiver is adjusted to the position which causes a zero dB meter indication when a sinusoidal signal with a level equal to the relevant level for continuous disturbance is applied to the r.f. input of the measuring receiver.

NOTE - Other calibration sources may be used (for instance 100 Hz pulses) However, due account should be taken of the CISPR weighting factor

The r.f. signal level corresponding with the above-mentioned zero dB meter indication is defined as the i f reference signal level

C.2.2 *Amplitude*

The amplitude of the discontinuous disturbance is the weighted reading of the measuring receiver and other devices specified in C 1

The amplitude can also be measured with an analogue circuit connected to the i.f. output of the measuring receiver simulating the electrical and mechanical properties of the detector and indicating instrument, respectively

In the case of close succession bursts of discontinuous disturbances the indicating instrument may show only one deflection exceeding the zero dB reference indication. It is then considered that each single burst exceeds the zero dB indication. The durations of those different disturbances are investigated according to the procedure given in C.2.3.

C.2.3 *Duration and spacing*

The duration and spacing of the disturbance is measured at the i.f. output of the measuring receiver either with a (storage) oscilloscope or a disturbance analyzer. For the determination of the duration and spacing of clicks only that part of the discontinuous disturbance exceeding the i.f. reference signal level (see C.2.1) and exceeding the relevant weighted response of the CISPR receiver (see C 2.2) is considered.

Duration measurements may also be performed on the mains supply current circuit of the device under test by connecting the oscilloscope to the artificial mains V-network provided that this will lead to the same results as obtained from measurements performed at the i.f output of the measuring receiver. In this case, the voltage at the mains frequency shall be attenuated sufficiently.

NOTE - Owing to the limited bandwidth of the measuring receiver the shape and possibly the duration of the discontinuous disturbance may be changed It is therefore recommended that the simple oscilloscope/artificial mains V-network measuring combination be used only when the "no amplitude limit" relaxation applies (see 4 2 3.4) that is to say the duration of each click is less than 10 ms and the click rate *N* is not more than 5. Whenever the amplitude and the duration of a disturbance has to be taken into account it is recommended that a CISPR receiver be used

C.2.4 *Rate*

The rate of discontinuous disturbance is called the click rate *N*, where *N* is derived from either the number of clicks per minute or the number of switching operations per minute multiplied by a factor *f* (see 3.5 and table A.2). *N* is determined during the observation time *T* (see 3.4).

C.3 Measurement of discontinuous disturbance

C.3.1 *Applying an oscilloscope*

The appliance to be measured is connected to an artificial mains V-network for the frequency range 150 kHz to 30 MHz. The measuring receiver is connected to the artificial mains V-network and an oscilloscope is connected to the i.f. output of the measuring receiver. The cut-off frequency of the oscilloscope shall be not lower than the intermediate frequency of the measuring receiver

The triggering of the oscilloscope shall be adjusted to the i.f. reference signal level (see C.2.1).

Only those disturbances causing the meter of the measuring receiver to exceed the zero dB value (with the attenuators set as specified in C.2 1) shall be evaluated.

It is recommended that for initial measurement of the duration and spacing of discontinuous disturbance the time base of the oscilloscope be set such that the whole display width is not less than 2 s.

If at the end of a 2 s interval or at the beginning of the next 2 s interval more than one click is observed (see 4.2.2.1) it is recommended that, in order to check the requirement "not occurring more frequently than twice in any 2 s", the measurement be repeated at a higher time base frequency.

In this way closely spaced successive clicks can be analyzed.

The following time bases are recommended to be used for further evaluating the duration of and spacing of discontinuous disturbance:

- for disturbances with duration shorter than 10 ms: time base 1 ms/cm to 5 ms/cm;
- for disturbances with duration not shorter than 10 ms but shorter than 200 ms: time base 20 ms/cm to 100 ms/cm;
- for disturbances at intervals of about 200 ms: time base 100 ms/cm.

NOTES

1 Such time bases make possible visual evaluation to an accuracy of approximately 5 %, which aligns with the 5 % accuracy specified for the disturbance analyzer (see C.1).

2 For assessment of each of the criteria mentioned above it is recommended that observations be carried out for at least 40 clicks or switching operations. It should be appreciated that if a particular criterion is assessed only once it must be assumed that the appliance always displays the same characteristics.

When storage oscilloscopes are used care shall be taken to use the correct writing speed otherwise the peaks of the pulses may not be completely displayed.

All conditions allowing the application of the click limit L_q shall be met before the click limit can be applied using the formula specified in 4.2.2.2, that is to say the limit for continuous disturbance is increased by an amount:

44 dB for $N < 0{,}2$, or

$$20 \lg \frac{30}{N} \text{ dB for } 0{,}2 \le N < 30$$

N is the click rate mentioned in C.2.4.

C.3.2 *Applying a disturbance analyzer*

The analyzer shall be connected to the i.f. output of the measuring receiver. The analyzer/receiver combination shall be adjusted in accordance with the instructions supplied and the performance checks of the measuring receiver shall be carried out as specified in CISPR 16, clause 2

The appliance to be tested is connected to an artificial mains V-network for the frequency range 150 kHz to 30 MHz, the measuring receiver is connected to the artificial mains V-network. The analyzer thus set up, automatically evaluates the discontinuous disturbance generated by the appliance. The analyzer will automatically indicate during the evaluation, whether the appliance generates continuous disturbance above the continuous disturbance limit, or whether the conditions allowing the application of the click limit L_q are met. Where the special conditions referred to in 4.2.3.2, 4.2.3.5 and 4.2.3.6 apply care shall be taken to determine whether any non-compliance indicated by the analyzer is valid.

If the click limit L_q applies, the formula specified in 4.2.2.2 is used, that is to say the limit for continuous disturbance is increased by an amount as described in C.3.1.

C.3.3 *Evaluation of results*

Compliance with the click limit L_q (calculated above) is assessed using the upper quartile method as specified in 7.4.2.6, that is to say the appliance under test shall be deemed to comply with the limit of not more than a quarter of the clicks or disturbances produced by switching operations are higher than the click limit L_q.

Amendment 1

Replace the reference number CISPR 14 *by* CISPR 14-1

Replace the existing title of this standard by the following:

Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus - Part 1: Emission - Product family standard.

Page 15

5.2.2.1 *Appliances normally operated without an earth connection and not held in the hand*

Add the following new text at the end of this subclause:

Equipment that, according to its design and/or weight, usually stands on the floor while in use (so-called floor standing equipment) is subject to the same provisions as above

However,

- the equipment shall be placed on a horizontal metal ground plane (the reference ground plane), but isolated from it by a non-metallic support (such as a pallet) of 0,1 m ± 25 % in height;
- the lead shall be led downward along the EUT to the level of the non-metallic support and be led horizontally to the artificial V-network;
- the artificial V-network shall be bonded to the reference ground plane (see CISPR 16-2),
- the reference ground plane shall extend at least 0,5 m beyond the boundaries of the EUT and have minimum dimensions of 2 m by 2 m.

Page 22

7.1.4, second paragraph

Change the second line into "1,1 times the rated voltage in order to check whether the level ..."

Page 27

Subclause 7.3.1 16.2

Replace the text of this subclause by the following:

7 3.1.16.2 *Paper shredders*

The device shall be tested for continuous disturbances while the device is fed continuously with paper, resulting in continuous operation of the drive (if possible)

The device shall be tested for discontinuous disturbances while the device is fed with one single sheet at the time, allowing the motor to switch off between each sheet

The paper shall be suitable for typewriter or copying machine, and shall have a length between 278 mm and 310 mm independent of the dimensions for which the shredder is designed. The weight category shall be 80 g/m².

Page 28

Add following new subclause 7.3.1.20 after 7.3.1.19.

7.3.1.20 *Air conditioning equipment*

7.3.1.20.1 If the air temperature is controlled by changing the time interval of operation of the compressor motor used in the appliance, or the appliance has heating device(s) controlled by thermostat(s), measurements shall be made according to the same operating condition as in 7.3 4.14.

7 3 1.20.2 If the appliance is a variable capacity type which has inverter circuit(s) that control(s) the revolution of the fan or compressor motor, measurements shall be made with the temperature controller setting at the lowest position when in cooling mode, and at the highest position when in heating mode

7.3.1.20.3 The ambient temperature for testing the equipment by 7.3.1.20.1 and 7.3.1.20 2 shall be (15 ± 5)°C when the appliance is operating in heating mode, and (30 ± 5)°C when it is operating in cooling mode. If it is impractical to keep the ambient temperature within this range, another temperature is also permissible, provided that the equipment operates in a stable manner

The ambient temperature is defined at the temperature of the air flow to the indoor unit

7.3.1.20.4 If the appliance consists of indoor and outdoor units (split type), the length of connecting refrigerant pipe shall be 5 m ± 0,3 m, and the pipe shall be shaped like a coil with a diameter of approximately 1 m. If the pipe length cannot be adjusted, it shall be longer than 4 m, but not longer than 8 m. The connecting leads between the two units shall be routed along the refrigerant pipe. Where an earthing conductor is required, but not included in the mains lead, the earthing terminal of the outdoor unit shall be connected to the reference ground (see 5.2 1, 5.2.2 and 5.2.3). The artificial V-network shall be situated at a distance of 0,8 m from the unit (either the indoor or outdoor unit) which is connected to the mains network

Page 45

8.3.1, 8th line

Replace the existing equation for the following

$$S_n^2 = \sum (x - \bar{x})^2 / n-1)$$

8.3.1, 12th line

Replace s_n *by* S_n^2

Page 55

Figure 9, 6th line

Replace $N > 30$ or $N > 2$ clicks in 2 s *by* $N \geq 30$ or $N > 2$ clicks in 2 s.

Amendment 2

Page 4

2 Normative references

Insert, in the existing list, the title of the following standard.

IEC 60335-2-76 1997, *Safety of household and similar electrical appliances – Part 2. Particular requirements for electric fence energizers*

Page 8

Renumber subclause 4.1.1.4 as 4 1 1 5 and add the following new subclause 4.1.1 4.

4.1.1.4 Limits for electric fence energizers apply to

a) the fence terminals on all energizers (columns 4 and 5 of table 1);

b) the mains terminals on energizers designed for connection to the mains (columns 2 and 3 of table 1);

c) the battery terminals on energizers designed for operation from a battery (columns 4 and 5 of table 1).

However, no limits apply to the battery terminals of energizers with built-in batteries which cannot be connected to the mains supply, or energizers with external batteries if the connecting lead between the energizer and the battery is shorter than 2 m and is not capable of being easily extended by the user without special tools

Type D energizers, according to IEC 60335-2-76, are measured as battery operated energizers with connecting leads between the energizer and the battery greater than 2 m in length.

NOTE – In practice the fence wire can also act as an active source of disturbances, due to the high-voltage discharges, in particular to radio and telecommunication networks Manufacturers of electric fence energizers should instruct the users to eliminate discharge points such as touching vegetation or a broken fence wire

Page 9

Replace the existing subclause 4.1 2 4 by the following new subclause 4 1 2 4

Regulating controls which incorporate semiconductor devices, electric fence energizers, rectifiers, battery chargers and convertors which do not contain any internal frequency or clock generator operating at frequencies higher than 9 kHz are not subject to the disturbance power requirements in the frequency range 30 MHz to 300 MHz

Page 37

7.3.7.2 Electric fence supply units

Replace the first paragraph of subclause 7 3 7 2 by the following new text

When measuring the disturbance voltage at the fence terminals of the electric fence energizer, the fence wire shall be simulated by a series RC circuit comprising a 10 nF capacitor (surge voltage at least equal to the no-load output voltage of the electric fence energizer) and a 250 Ω resistor (the 50 Ω in parallel with 50 μH incorporated in the artificial mains V-network provides the balance of the required 300 Ω load resistance) connected as shown in figure 6

The leakage resistance of the fence wire is represented by a resistor of 500 Ω placed in parallel to the series circuit.

A correction factor of 16 dB shall be added to the measured values for the fence terminals due to the voltage division resulting from the use of this fence equivalent circuit

When measuring, the appliance shall be operated in the normal position with a maximum inclination of 15° from the vertical position.

Page 52

Figure 6

Amend the definition of item 4 to read

Mains lead, or battery lead

Replace the definition of item 6 by the following new definitions.

6 Resistor of 500 Ω to simulate leakage (to be added to the equivalent circuit of item 5)

Add the following note to figure 6

NOTE – The left V-network is not necessary when the EUT is battery-operated The right V network may protect the meter against pulses in the dummy fence

Replace the existing title of figure 6 by the following new title·

Figure 6 – Arrangement for measurement of disturbance voltage produced at the fence terminal of electric fence energizers (see 7.3.7.2)

(*Continued from second cover*)

The concerned Technical Committee responsible for the preparation of this standard has reviewed the provisions of the following International Publications and has decided that they are acceptable for use in conjunction with this standard :

> IEC 60335-2-76 : 1997 Safety of household and similar electrical appliances — Part 2 : Particular requirements electric fence energizers

Only the English language text of the International Standard has been retained except figures while adopting it in this Indian Standard.

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